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APRIL, 1919

The Relief Fund Committee.—*Frontispiece.*

Ideal Method of Brushing the Teeth.
—*Charters.*

Articulation in Artificial Dentures.
—*Weiss.*

Orthodontic Appliances and Gingival Tissue.
—*Rogers.*

Diagnosis and Treatment of Conditions Resulting from Diseased Dental Pulps.—*Coolidge.*

Sterilization of Dental Instruments and of Root Filling Materials.—*Pond.*

Bacteria Found in Apical Tissues and Pulp.
—*Collins.*

The Dental Hygienist.—*Editorial.*

1919 Aim 32,000 Subscribers

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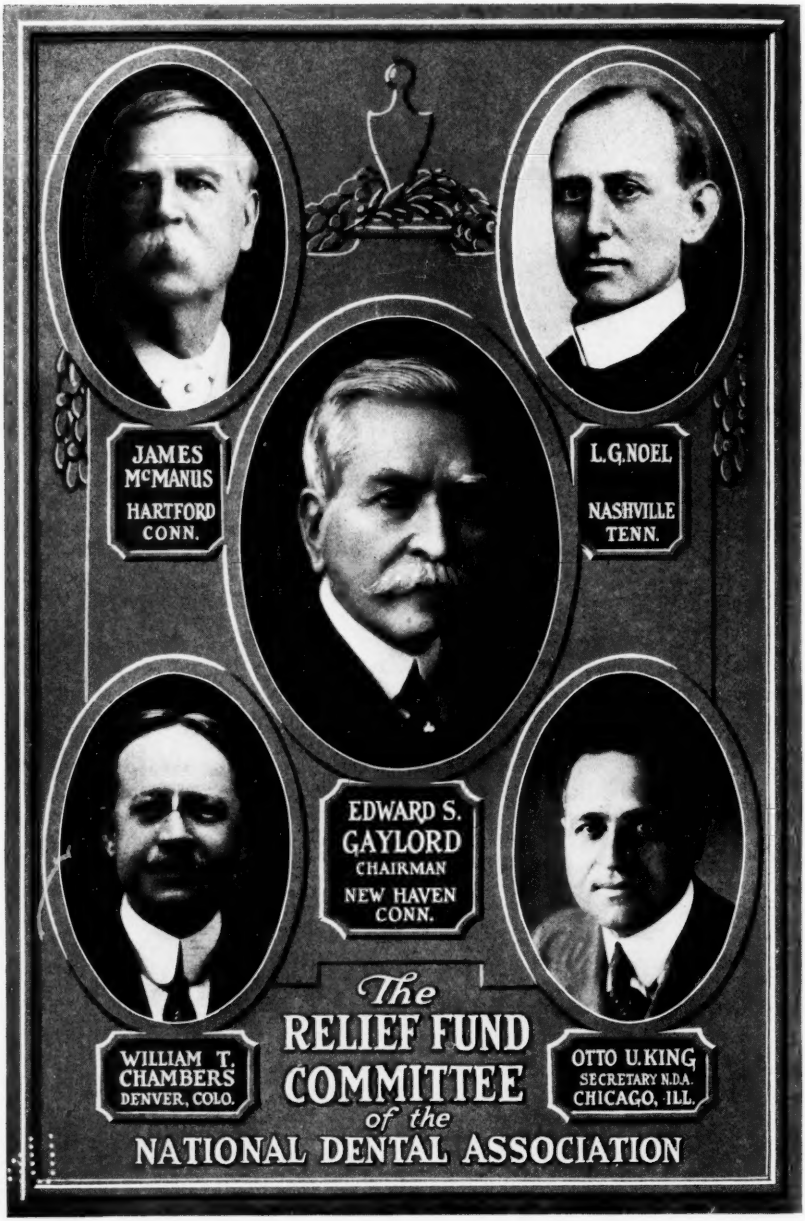
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The RELIEF FUND COMMITTEE of the NATIONAL DENTAL ASSOCIATION

THE JOURNAL
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Original Communications.

THE IDEAL METHOD OF BRUSHING THE TEETH AND STANDARDIZING THE TOOTH BRUSH.

By W. J. Charters, D. D. S., Des Moines, Iowa.

(Read before the National Dental Association at Its Twenty-Second Annual Session, Chicago, Ill., August 5-9, 1918.)

IT IS a very difficult matter to determine the real cause of many of the ailments from which the human race is suffering. Many of these troubles evidently had their origin many centuries ago, and conditions as we find them today are the direct result of some biological or sociological change which started at some great crisis in the life of man. Some radical change in man's method of living, we are told, caused the atrophy of a second intestine to what is now the appendix, and appendicitis is one of the penalties man paid. Constipation is said to be one of the results of man's assuming an upright position in walking.

The foreshortening of the human jaw is responsible for the trouble with the third molar. The lack of use of our jaws made it unnecessary for them to be so strong, hence another penalty for our less strenuous life.

The wild animals living in their natural state have no such trouble. Man at one time lived in the same way and was undoubtedly free from these maladies at that time. One great difference between our wild friends and ourselves is in the matter of diet. They live on a simple, natural, raw food, while we live for the most part on a complicated cooked food in combinations that are sometimes appalling.

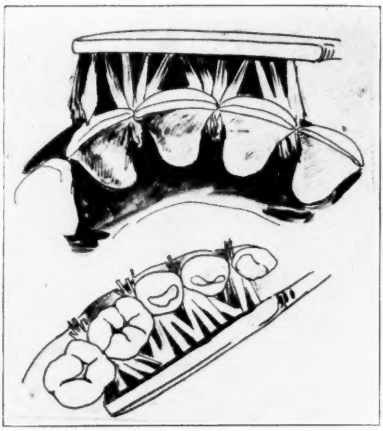
The greatest crisis in man's development evidently came when he discovered fire, and began to cook his food. Had he continued to live on the simple raw

Figure 1.

A—Showing how it is possible to cleanse the approximal surfaces when the bristles are properly placed.

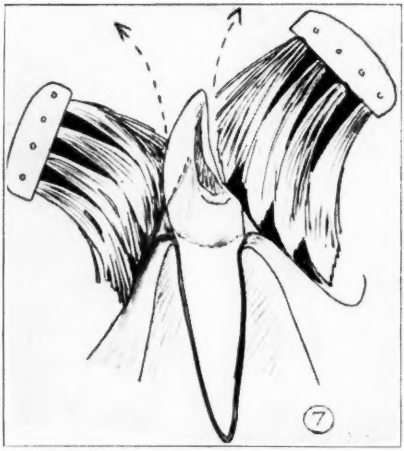
B—Representing the difficulties the beginner will have in properly placing the bristles between the teeth. The difficulty, however, is overcome by practice.

Figure 3.



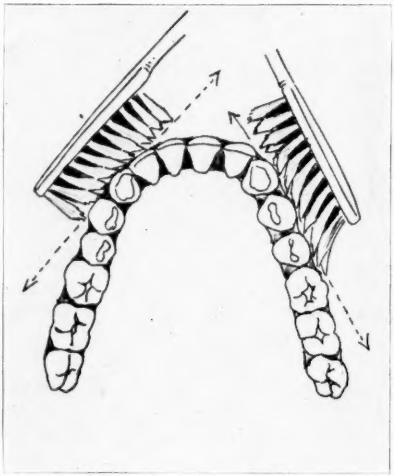
Buccal and Lingual positions of the bristles, ideal method.

Figure 2.



Cross section showing the old up and down and rotary methods of brushing. Note the uncleansed area between the contact point and the gum.

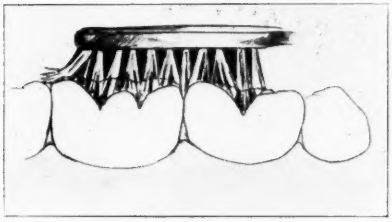
Figure 4.



An old method of brushing, showing the bristles merely cleansing the most prominent portions of the teeth which are normally clean areas.

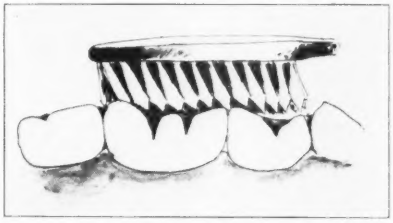
diet he may never have had these dental disturbances; but perhaps he never would have attained the mental development enjoyed at the present time. It is impossible to prove that this change from raw to cooked food is responsible for these troubles; but is it not reasonable that such a radical change in diet would force a multitude of digestive adjustments which would finally result in changed tissues and secretions? The fact that wild animals brought into domestic relations with man, and fed upon a different diet often develop dental caries, pyorrhea, and other mouth diseases seems to substantiate this theory. If it

Figure 5.



The ideal method of brushing the teeth, showing the bristles reaching into the fissure and sulci.

Figure 6.



Incorrect method of brushing occlusal surfaces, the bristles only touching high points and gliding over the fissures and sulci.

be true that the working of the law of compensation in the matter of food has deprived man of his ability to resist the diseases, then in order to regain that lost immunity man must return to a raw natural diet, or find just where his present diet is responsible for his weakened resistance. Exercise is vital to some tissues, and perhaps the lack of it is somewhat responsible in this case.

Soft cooked food does not demand the same grinding machine that hard, raw, fibrous food does, and so nature automatically reduces the machine to fit the food, and thus lowers the vitality of the tissues involved.

It is obvious that man will not return to a raw diet, at least in time to render any benefit to many future generations. We must content ourselves, for the present at least, with the treatment of symptoms, instead of initial causes. The results obtained by these treatments are sufficiently good to warrant their general use. Cleaning the teeth and other tissues of the mouth is simply the treatment of a symptom of the primary disease. Animals use no such methods, and yet are free from the very things we try to prevent by these means in our own mouths. It is therefore plain that artificially cleaning the mouth would be entirely unnecessary if the general system was properly functionating.

If a man is to be freed from trouble with his teeth he must do one of two things. He must know it is necessary to either find the initial cause, and eradicate it, or care for the mouth in such a manner as will prevent or cure these troubles.

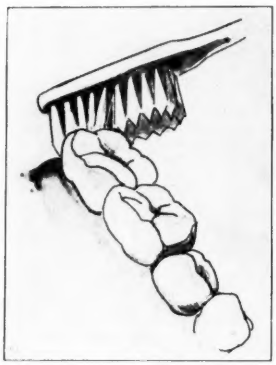
The Ideal Method of Brushing the Teeth.

I will first drill on the brushing of children's teeth. We will presume the gums are practically in a normal condition, and we are going to keep them in this same condition. Now, the method I am going to describe and demonstrate to you will no doubt lead some of you to believe that this method of brushing will injure the gums. For the benefit of those who may be of that opinion, I beg to say that it is not true —any more than with any other method

of using the tooth brush—as it has been tried out on a great many children with no injury, but to the contrary has done a great deal of good in every case.

Again some may say the gums will be pushed back out of the interproximal spaces in a normal mouth. For the benefit of those who may believe this to be true, I will state that it is impossible to make the gums recede where there is a normal alveolar process. As has been stated before there are no just grounds for those claims. This will be proven

Figure 7.

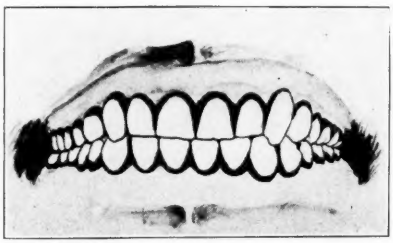


Correct method of placing the brush to reach the seemingly inaccessible distal surfaces of the molars.

in my pictures of a child's mouth, a picture taken before and two years after this method of brushing and no change has taken place in the gums, except that of a harder and firmer gum tissue. Nature builds up a firmer gum tissue to withstand the friction caused by the tooth brush. The gums in the mouth of a few people appear to be immune from gingivitis and eventually pyorrhea, but a large percentage of the mouths are subject to the ravages of these diseases, and it is up to the dental profession to practice and teach preventive dentistry as much as possible that pyorrhea and decay may be eliminated to the greatest extent possible. Preventive dentistry has not been taught by the dental profession to any great extent so far, as our time has been occupied by the curing of mouth ills, but the time is coming, and not very far off, when we will be devoting a great deal of our time to the prevention of mouth diseases, instead of curing the same.

The virtue of this method of brushing can be better proven in mouths of people where pyorrhea has started, especially in advanced cases where the gum is soft and the alveolar process disintegrated this condition leaves open interproximal

Figure 8.



Showing the condition that exists following the old methods of brushing, the dark area around the gingiva representing the undisturbed food film.

spaces which make it easy to place the bristles between the teeth.

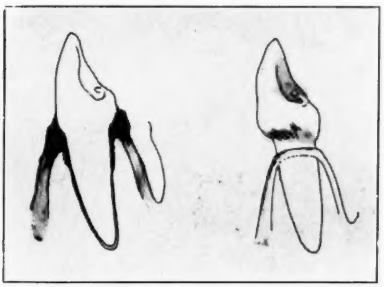
The real cause of either dental caries, or pyorrhea has never been found, but it may be assumed that any irritant, of whatever nature which impairs the integrity and continuity of the gingival gum margin may cause pyorrhea.

The irritation which may dissolve the integrity of the gingival border may be presented in various forms, such as calcareous deposits, the vicious use of banded crowns, poorly fitted clasps or retainers on partial dentures, improperly finished fillings, etc.

I wish to state that in almost all cases of medium, or advanced cases of pyorrhea, and this condition exists in almost every mouth of over 30 years, and for the benefit of those who are skeptical I

would suggest, that when you return to your offices that you examine with a sharp explorer the first 50 patients that present themselves for any kind of mouth service, and note if the statement I have just made is correct. In making these examinations see whether or not the alveolar process is flat or concave, labio-lingually and bucco-lingually in many cases where it originally was convex. Now, it has been observed that in these cases ideal brushing will render the gingiva hard, in fact so hard and tough

Figure 9.



Showing an infected tooth before and after excising the diseased gum tissue and brushing.

that you are unable to crowd it back any farther with any method of brushing and still you have the concave surface of the alveolar process.

At present there is no method of brushing that will reach this surface just referred to, so what is the result? We must resort to surgery and remove the gum and process to be in line or even lower than the center of the interproximal surface labio-lingually or bucco-lingually. This is a very simple operation and I believe it absolutely necessary in keeping the mouth clean. It must be remembered the tooth brush does not remove the film deposit out of the mouth that has been brushed from the teeth, but on the contrary with the aid of the saliva and dentifrice has rendered the food film into a liquid form and with an abundance of water it is very readily washed out.

In my belief there is no medicament that can be used in the mouth without deleterious effects that will cure pyorrhea, and if this statement is true there is no other course to pursue but to wash out the bacteria which may be easily accomplished, providing we have eliminated the inaccessible pockets, by taking a mouthful of warm water, then by bringing into occlusion the teeth and lips, forcing the water back and forth between the teeth. Use from one to two glasses of water for this purpose. Remember we should wash the bacteria out of the mouth rather than attempt to destroy them medicinally.

Discussion.

J. M. Temple, Tulsa, Oklahoma.

I have taken a great deal of interest in the paper and the manner of brushing which the Doctor advocates. I must admit that I advocate some other form of brushing. I can see the advantage of his method in some cases, but I cannot see that he can claim any advantage except in the ideal case. Undoubtedly he gets a stimulation from that brushing that he could not get by the sweeping motion. There is a space just at the gingival line, passing from the gingival tissue into the surface of the tooth that necessarily would be neglected by the sweeping method. That was called to my attention by one of my patients. I was suggesting to him the sweeping motion of placing the brush way up under the cheek. He asked me this question, "What becomes of the small surfaces where the bristles slip over from the gum surfaces of the tooth?" His exercise of mind was greater than mine had been. I had not thought of that. That is very nicely brought out in this manner of brushing.

I am not convinced how the Doctor

can accomplish that brushing where the contact point reaches back or nearly to the gingival line. It seems that it would be almost ideal in long teeth but in the average case I believe we want to resort to something more than getting those bristles in. That looks very nicely on the screen, but I believe we will have to have something other than that. That method of rotating the bristles properly, of cleansing those surfaces and stimulating that region is a very good one. I am sure that has been the objection to most of the methods.

A. C. Thompson, Detroit, Mich.: I would like to ask this question. Would it not injure the gum tissue or the tissues that lie immediately beneath by placing the bristles as the essayist has indicated in his excellent paper? It seems to me that dividing the bristles in the fissure under the masticating surface of the molars and bicuspids is splendid, but the question comes to my mind whether or not dividing the bristles along the gingival line causes injury.

Dr. Bercher, Fargo, N. D.: In removing the diseased process do you remove the process and the gum, or just make an incision and remove the process? I find in my experience that where I have removed the gum, this operation is very successful. I have a great deal of trouble in getting my patients to use such a method of brushing the teeth, altho I use a method very similar—it is a rotary method. I have discontinued that procedure of cutting the gum for that reason. In your procedure in case of pyorrhea, do you go along and remove this process?

Charles H. Oakman, Detroit, Mich.: I am sorry I did not hear the essayist's paper, but from a few remarks he has just made, I am not sure of his method. We know that in some cases of hypertrophy of the gums, considerable of the gum tissue can be removed with beneficial results. This is also true in certain cases of pyorrhea. In these cases, after the gum has been excised, we have a deficiency of gum tissue. It is better to have a small amount of healthy tissue than a super-abundance of inflamed, infected gum tissue and process, which sooner or later is destined to cause the loss of the teeth. If one of the important principles of surgery is not maintained, that of proper drainage, we cannot hope for the best results.

George F. Burke, Detroit, Mich: The paper as presented by the essayist is especially interesting because of what he suggests in connection with the treatment of pyorrhea. It recalls to my mind again the great variety of methods of personally caring for the teeth. At the last annual meeting of this society Rhein of New York and Fones of Bridgeport had a very vigorous debate before a large audience on the merits of their respective methods of personal care of the teeth. Where men like these differ on this matter, is it any wonder that there is such confusion and diversity of opinion in the profession generally relative to this subject?

Personal care of the teeth is becoming more popular these days, but a great amount of harm is done because patients do not know how. Anything that is worth while should be systematized, and this is surely one of them. This association could do a valuable work by appointing a committee to thoroly go into this subject.

A dental histologist of standing, likewise a high grade pathologist, and others prominent in dental practice should, it seems to me, compose such a committee, and when they have concluded their work what a splendid service would be rendered by giving to the world their message in brief, simple form with suitable illustrations.

W. G. Ebersole, Cleveland, Ohio: I am sorry that I did not hear the paper

because it was the one paper of all that I wanted to hear. That I was not in attendance is no fault of mine. I was on a committee of yours that had to make a report.

I get it from Dr. Oakman's statement and from the statement made in answer to a question by the essayist that the essayist is cutting away the gum tissue in order to eliminate the pockets. I have been trying that in extreme cases for some considerable time and while I would not advocate it in every case, there are cases where it is necessary. By this means, I have been able to remove pockets around some teeth. Where it is the plan to use this method remove as much of the gum tissue forming the pocket as possible, the gum will settle down and we will be able to eliminate pockets that we could not eliminate otherwise. Dr. Oakman's criticism is not justified because that gum tissue instead of being a protection is a menace. If you have a deep pocket and cut the tissue, remove that portion forming the pocket and you will obtain very gratifying results.

Brushing of the teeth and the standardizing of the same is a thing in which I am deeply interested. Not having heard the paper, I will not attempt to discuss it. I am interested in the statement that 80 to 90 per cent of the cases have pyorrhea. I think you must mean neglected cases.

Dr. Charters: They were not all neglected.

Dr. Ebersole: Then I must take issue with you. I have been too long in this game not to have seen a change in the mouths of American school children, where work like Dr. Howe has been doing, or Dr. McFadden in Pennsylvania, some of the work in Detroit, and some of the work in Cleveland. I examined schools and in one year I have seen children taught to keep teeth and the mouth clean. Where you get your propaganda to the people in the right shape, the mouths are not all neglected. When you start with the children and educate them to the point where they feel like criminals if they neglect their teeth and where they would no more think of going to bed at night without brushing their teeth than they would think of going to bed with their shoes on, then you do not have any such percentage. If you are including all the people who are not making efforts to take care of the mouth and all the people who are not making effort thru the propaganda that has been introduced in the schools, your proportion of pyorrhea is going to be way beyond reason. You are only scratching on the surface now and there will be no excuse if we come to the public with a standardized method. As Dr. Burke says, that is only one thing to do. If one equally good man comes along and says, "This is the way," and another equally good man comes along and says just the opposite, how are we going to know which is right? It is the individual's ability to apply the thing not only to himself but to communicate his ideas and his methods to some one else. I have seen in recent years the work of Dr. Henry Barnes, of Cleveland, who takes the smallest tooth brush that can be purchased and gets the most beautiful and satisfactory results with the use of that little brush, even when failing to remove the deposit around the neck of the teeth, he gets wonderful results. That man in his practice has been able to carry out his ideas and inject his personality into his work, so that he has been able to obtain such wonderful results. You have to put into these cases a personal equation. I feel we must have a standardized method of brushing, a method that we all can recommend. It has been suggested to me that a motion be made that this section take that matter up with a view to endeavoring to report back to this section next year on a standardized method of caring for the mouth.

Dr. Charters: Why not include in that the brush?

Dr. Ebersole: Of course if you are going to standardize a method, you must standardize the tools. I prefer to leave the brush out of the motion, because when you standardize a thing you have to standardize the instruments to do the work with. I move, Mr. Chairman, that a committee from this section be appointed for the purpose of trying to standardize the care of the mouth. There is going to be a whole lot of work to be done. This is a thing that is timely and a thing that should be done now.

Sidney J. Rauh, Cincinnati, Ohio: The essayist has advocated a curative measure rather than a preventive one. The tooth brush is only partially a cure, its use is primarily a preventive measure. The late Dr. M. H. Fletcher, who did much to bring about this Oral Hygiene movement, advocated a horizontal stroke with a large straight, stiff brush. Dr. Barnes of Cleveland uses the smallest of brushes, as soft as possible, soaked in soap and water. There are numerous other methods, all, however, advocating reaching the gingival margin. This is real standardizing. The essayist shows pictures with the bristles between the teeth. This we have not been able to accomplish. In fact, in my lectures to the public I demonstrate that you cannot do this. Therefore, the other appliances, such as the toothpick, floss silk, pastes, washes, etc., and the individual idea of the operator must come into play. There are two distinct problems, one is the problem in your office which you have the privilege of treating just as you would any office problem; the other is the method which the profession must teach to the people to let them know how to keep their mouths clean and this must be standardized. The personality back of the essayist gives the remarkable results of which he speaks. In our offices, by direct contact, we do get results. But there should be a method whereby a group of twenty-five children can be taught, in a few minutes, how to brush teeth.

Another very important point to my mind is the education of the dentist himself. (Applause.) In this room probably each person is in sympathy—but where is your attendance? How many men attend these meetings regularly? Therefore, your propaganda must extend to the profession before it extends to the public and the individual. We have standardized one thing—the fact that you must reach the gingival margin. If a committee is formed, you cannot work out a system in a year. I think it would be a mistake to come before the National Dental Association next year and say, "Here is a system which will work."

We have carried on an Oral Hygiene movement in Cincinnati for eight years and we have succeeded in standardizing a tooth brush method for the public if not for private operators. When we go to the schools or Mothers' Clubs we have a standardized method. Unfortunately this is a method that the essayist does not advocate but we do get results. The written instructions are as follows:

TOOTH BRUSH DRILL.

Attention—Hold brush up in right hand at the heighth of the shoulder, in front of child. (This is to see that the tooth brush is clean.)

UPPER TEETH.

1.—Place brush in mouth, upper right, where the gum and the teeth join. Turn down towards grinding surface eight times.

2.—Brush upper front. Place on gum and turn down eight times.

3.—Brush upper left. Place brush on gum turn down eight times.

4.—Brush upper right inside. Place brush on gum and turn down eight times.

5.—Brush upper front inside. Place brush vertically, brush down eight times.

6.—Brush upper left inside. Place brush on gum and turn down eight times.

7.—Place brush on grinding surface of teeth, upper right, scrub forward and back eight times.

8—Place brush on grinding surface of teeth, upper left, scrub forward and back eight times.

LOWER TEETH.

9.—Place brush in mouth, lower right, where the gum and the teeth join. Turn up towards grinding surface eight times.

10.—Brush lower front. Place on gum, turn up eight times.

11.—Brush lower left. Place brush on gum, turn up eight times.

12.—Brush lower right inside. Place brush on gum, brush up eight times.

13. Brush lower front inside. Place brush vertically, brush up eight times.

14. Brush lower left inside. Place brush on gum, turn up eight times.

15.—Place brush on grinding surface of teeth, lower right, scrub forward and back eight times.

16.—Place brush on grinding surface of teeth, lower left, scrub forward and back eight times.

Attention—Hold brush up in right hand, at the heighth of the shoulder, in front of the child. (See how clean the brush is now.)

Next—See that each child's brush is thoroly rinsed with fresh water and put away in a clean place.

One time it became necessary for us to raise funds for our work. In that campaign we did various things. Among other schemes, we had to tooth brush drill for publicity. Ten children from one of the schools in a poor district were taught a tooth brush drill in five minutes and placed in a conspicuous show window, they attracted a large crowd, which they held.

The method that achieved this was one not advocated by the essayist. Of course, such rapid results cannot be hoped for when dealing with adults. Can they be attained by this method or any other? Do you advocate this as a universal method of tooth-brushing? If so, how would you teach it to a class-room of children?

W. G. Ebersole, Cleveland: Dr. Rauh raised a very important question, that we will not be able to make a complete report in one year's time. It takes time to accomplish things and no one realizes it more than I do, and any one who undertakes this work is going to get into a hotbed of discussion and dissension. But let that committee be composed of men and women who have had experience enough to carry some weight and then not come to the convention next year to say that the method presented is an ideal method, but let it come to this organization next year and say that in the light of what we now know this method is the best and then at this time let us recommend that this committee be continued until they work out a scheme, or that another committee be appointed, which may complete the work undertaken. A method that you can offer as coming from a National committee of men who have been studying this problem for years and who have done successful work will be acceptable. You will have a hard time getting them together and securing an agreement as to methods, but you will if you persevere. We cannot all agree—we have got to make concessions to one another. I met a committee last night and we could not agree, so we had to make concessions to accomplish something. You have to have men and women on that committee who can make concessions. I think now is the time to begin standardizing and to work for a final decision. I think we are big enough and broad enough to do it and do it now.

Albert L. LeGro, Detroit: I have not really a paper, as the chairman suggested, on this subject. I have

some things in mind, however. It took a very short time after coming in contact with Dr. Charters and his work to convince me that I was in the wrong as far as brushing teeth was concerned. I was at Des Moines giving a clinic and one evening after finishing my work, somebody suggested that we go to Dr. Charters' office and watch him brush teeth. I said, why should I go over and watch somebody in Des Moines brush teeth when I had been going up and down this country for the last three or four years and had seen men advocate different methods and each man knew more than the other man?

However, I went to Dr. Charters' office. He said to me, "Doctor, I understand you have made some study of this particular work and I would like to demonstrate to you the charts of the patients on whom I have tried my method." I said, "Yes, I had." He showed me charts and they were wonderful, but of course I would not admit that. We went into his office and he asked me if I would mind going thru my method of brushing teeth. He took out a new brush and I went to work and brushed my teeth and I gave them the very best brushing they had ever received. When I finished he asked me if I would sit down in the chair and let him go thru his methods. He gave me a mirror to hold so that I could watch his methods. The longer I sat there the more I became impressed with each step. Now I will say before I read this short little paper that I am sorry that each and every one of you men cannot have Dr. Charters try his method on you. I went into his office a skeptic, feeling there was nothing in his methods. Now I do not think there is anything quite equal. It might not be quite original. You may have known about it, but the way he has done it has left a profound impression on me.

Mechanical cleanliness as a prophylactic primarily and as a procedure to maintain a condition secondarily, is the first accomplishment, habit or whatever you choose to call it, in preventive medicine.

Those who recommend to their patients that the upper gums should be brushed downward and the lower gums upward, towards the cusps and incisal edges in order to break up the gelatinous plaques, infectious food films and other deposits was therefore not wrong in their admonitions but in view of what has been accomplished by means of Dr. Charters' method, he was only partially right.

Rosenau says: "Normal mucous membrane, sound teeth and healthy tonsils are the best protection we have against the invasions of microscopic parasites." As most pathologic conditions of the gums and alveoli are primarily brought about by neglect of mechanical cleanliness and are the resultant conditions that should be eliminated by the first law of therapeutics, namely, removing the cause.

As the essayist has pointed out, we are living under conditions that nature does not seem to have anticipated.

If normal occlusion of the teeth by means of sanitary replacements or orthodontia or both as the case demands, with properly distributed functional stimuli, is accomplished, mechanical cleanliness is essential no more nor no less than in perfectly normal mouths. In other words it is the kind of food and the way it is prepared that we have to contend with today and makes necessary the study of mouth hygiene and how best to accomplish it.

A tooth brush is but a large collection of minute toothpicks and should be used as such, as purely a brush with which to remove particles from all surfaces of the human tooth, the bristles are a failure but as toothpicks they are each and every one of them a huge success.

Five typical cases of incipient recession we stained with disclosing solution in my office—usual method I have

already described—supplemented by the up and down and rotary methods, failed to remove the stains from the gingival region except where buccally and labially prominent.

The rotary method seemed to accomplish more than the up and down methods. The same teeth were stained again and the Charters' method employed, removing all the stain, even on the approximo-cervical surfaces. This advantage is a minor one. Both my Periodontist and myself have used this method in many cases of Pyorrhea and other alveolar and gingival pathological conditions and the result in each case has been remarkable.

To see mouths that have been persistently unresponsive to the most careful treatment, return within a short time to a healthy condition was a revelation to me.

Pyorrhea in its secondary stage, under this method of tooth brushing seems to disappear and cases that formerly took quite a time to eradicate, are rendered healthy in a comparatively short time.

The enthusiasm of the patients seems to be spontaneous and they seem to realize very quickly the advantage over other attempts that have been made in their mouths.

I feel grateful indeed to Dr. Charters for teaching me this most excellent procedure. Unhealthy mouths with overhanging fillings, crowns and illy conceived and executed bridge have been subjected to this method of brushing with most gratifying results.

When one first witnesses Dr. Charters' demonstration, he is not impressed with it and immediately in his mind is evolved many objections to it. I wish that each and every one of you could go to him with a proper tooth brush and have him go over your mouth and I feel quite sure that within a day you would be converted from a skeptic to an enthusiastic partisan in its favor.

William J. Charters (closing): In answer to Dr. Thompson's question, you cannot injure the gum tissue. That is impossible. The pyorrhea has already done a great deal of damage. You can not begin to do the damage that the pyorrhea is doing. As we understand it, 90% of the mouths will have pyorrhea. If that is true, those teeth are going to be lost sooner or later and the disease is going to do a great deal of damage systematically to the patient. Why talk about the bristles harming the gum when the pyorrhea is going to cause the loss of the teeth sooner or later? You cannot injure the gum tissue with a brush used in this manner.

The gum should be removed so as to eliminate all pockets. It is much better to have large spaces between the teeth and roots so that bristles can polish the tooth surfaces that has been affected than to have inaccessible pockets. I remove the process to make it convex between the teeth, instead of concave. There is no brush that will remove the food particles from under the gum, so we must remove the gum which is unsupported by alveolar process. Don't allow yourself to be convinced that after you treat pyorrhea pockets that they will fill in with bone tissue to almost a normal condition. If you do you will be greatly disappointed.

In answer to Dr. Bercher's question I anesthetize the gum, and with special shape lancets a half an inch at the end bent at right angles, and the cutting surfaces at different angles, which allows cutting forward or backward with the instruments, I am able to remove a "v" shape piece of gum buccally or lingually at the interproximal space or between the roots of the molars. In removing the gum I expose the alveolar process. Then with small plain fissure burs I remove these plates of process to be in line with the process between the teeth. By doing this there will be no concave surface between the roots to act as a

receptacle for food. Then pack cotton, saturated with uroform paste between the roots. Repeat every day for two or three days, or until the gum tissue has formed over the process. The surfaces will be tender to the tooth brush for a short time only.

In reply to Dr. Rauh, I believe it impossible to teach a class of children in so short a time to brush their teeth correctly. You cannot teach this method of brushing the teeth by standing up and talking to the children. You can show them how to take the tooth brush in their hands and then in the mouth and then it is all over. You can tell them to brush up and down. Now if you notice these pictures, there is probably a third of the surface that is not touched. If that is all you are going to teach, it is easy to teach children, but you have neglected a third of the surface of the teeth, and the surface that needs the most brushing. If we are going to make the teeth clean, we must exert friction on the surface that needs attention. As I have shown you, you cannot get the bristles in between the teeth unless you place them there, and you cannot get them there with a sweeping motion. I will admit that this method is very difficult to perform. In fact, I cannot teach it in one sitting. It will take ten, or fifteen or possibly more lessons, but I keep at it until I do get the patients to do it thoroly. The tooth brushes are brought to the office and kept in test-tubes and the patients come every day or every other day. If they show reasonable skill I will keep them until they accomplish the method. If I cannot teach them, then they are dismissed that no time will be misspent.

There is one objection to this method and that is it is hard to accomplish. If you can teach people to play the piano, why can we not teach them to clean the teeth correctly? In order to clean the teeth we must come in actual contact with them. You cannot do that with the sweeping motion because there are too many small spaces. Short teeth are difficult to brush, but they are difficult with any method. You must get between the teeth and try and work the bristles in between the V shaped spaces between the teeth. Crowd the bristles down on to the gum. The gums and intraproximal spaces require a lot of friction. The more friction the firmer the gum. You cannot brush the gum away from the intraproximal spaces where the gum is normal or healthy.

In regard to removal of the gum, as Dr. Ebersole said, it is all right in some cases. I have been referring to cases where there are pyorrhea pockets. There is no method of brushing that will clean these pyorrhea pockets to any extent, before they have been trimmed. That surface must be cleaned and how are we going to clean it unless we make the surface accessible to the brush. Cut the gum away that we may make friction on the roots of the tooth. Otherwise you cannot clean them. If we have a plate of process standing up between the gingivas we have a concave surface between the teeth and that will be hard to clean. Let us make it convex, so it is easier to get the bristles in. That seems quite reasonable to me.

As I said before, I keep on teaching this to the children and to my patient until they grasp the idea, but you cannot tell patients how to brush their teeth and have them go on and brush them properly, unless you have actually done the brushing in the mouth. I have tried teaching without demonstrating, getting poor results, but now with this method of teaching and brushing I am getting wonderful results. Try it and you will be convinced.

SOME QUESTIONS OF ARTICULATION IN ARTIFICIAL DENTURES.

By O. A. Weiss, D. M. D., Minneapolis, Minn.

(Read before the National Dental Association at Its Twenty-Second Annual Session, Chicago, Ill., August 5-9, 1918.)

IN PRESENTING this paper I wish to preface it by saying that it was only at the very urgent request of your chairman of the prosthetic section that this presentation is offered at this time. I may say further that this is a substitute paper asked for at the eleventh hour, coming just at the close of my college work, and after an unusually strenuous year involving many trials of a very severe nature, thus finding me in a state of mind not at all conducive to the best preparation of a scientific paper upon the difficult, complex problem, particularly too in the absence of essential data.

Your chairman, however, insisted that the subject of articulation needs further discussion—I surmise he wishes to discuss it, more particularly because of his intense interest in the subject as related to his special field of work.

He maintained, even tho the last word upon this topic may not yet be uttered, a discussion at this time would nevertheless be very valuable.

To this appeal, I finally yielded tho not without some regret, for I should have much preferred to have some positive evidence, which I hope to have some day, regarding some of my views upon the subject of articulation of artificial dentures.

However, with the list of discussers scheduled, I think you have promise of a lively discussion, and with this it may be hoped that you will find your time has not been spent altogether in vain.

It will not be my aim to present a full and comprehensive discourse upon the broad subject of articulation of artificial dentures. As may be inferred from the title, I shall deal with certain features only, features which I believe are somewhat overestimated and over which there is unwarranted enthusiasm accompanied by increased work without compensating benefits, and which in turn tends only to react unfavorably upon the subject.

I have for a long time contemplated making some actual tests of articulation of artificial dentures—comparative tests in the mouth—of the different ideas advanced from time to time, to determine if possible the value of articulation and the methods of obtaining it.

There can be no question that in this as in other branches of dentistry, clinical test must determine the value of a theory or method of practice. Mere discussion or theorizing, however beautiful the rhetoric or scientific the garb, will avail but little if it does not enable the practitioner to carry home something he can use and give his patients better service, not merely in theory but in demonstrable facts.

When I began articulating teeth some twenty-five years ago, it was by the Bonwill method, using the Bonwill anatomical articulator, and I am frank to say met with success, success in satisfying my patients because they believed what I told them, not that I demonstrated the

truth to them or to myself. They simply took it for granted that the teeth made for them were all right because I said so, and I felt that I knew they were correct. Dr. Bonwill gave us no method of testing an articulation. We were told that if the articulation was properly made in the articulator, it would be correct in the mouth. He did admit, however, that occasionally it might be necessary to "grind a cusp a little here or there." We took it for granted, therefore, that after spending some laborious hours in articulating a set of teeth in the anatomical articulator that they would articulate properly in the mouth. There was no explicit instruction given for determining the "here or there" in order to grind a little more. If after the teeth were placed in the mouth and the occlusion appeared correct when the mouth was closed in normal repose, and the patient was able to make lateral movement which as a matter of fact in a very large percentage of cases consisted principally of lip movement because the teeth were locked together by deep meshing cusps, the test was finished and adjudged satisfactory.

That the teeth did not often glide over each other in lateral movement except as the patient occluded very lightly to permit doing so, seems to have escaped observation; or if they did glide over each other in lateral movement and the teeth remained in occlusion, there was no doubt as to the articulation being correct. It did not occur to the dentist in such inspection of his work, that he had failed to discover that nearly always the plates lifted from the alveolar ridges on one side when lateral movement was made, and while the teeth were in occlusal contact, the plates were not resting upon the ridges—usually the lower one alone lifted from the ridge—on the side where the mandible had moved downward because of inclination of the condyloid path. The mere fact of occlusal contact of the teeth in lateral movement, and this practically always occurs, was all the proof of correctness of articulation that the dentists sought; that the plates did not rest upon the ridges in this movement of the mandible was not usually discovered. The careful observer, however, did discover this serious error, but not until Walker showed us that the condyloid path is inclined did we have any idea as to why this condition existed or how to remedy it?

After Walker showed the error in the Bonwill articulator I embodied the principle of the inclined condyloid path in my work, but I must confess that I was not at all certain that I gave my patients any better service or that they were any better satisfied than former ones. These patients used the teeth with satisfaction the same as those before. However, I now found how to make correct articulation which I then knew was not done in my former work; I concluded therefore that my later work was superior to the former.

I may state here that occasionally I would see some of my earlier patients and in some instances tried to show them that we now have a more perfect system of articulation, hoping I might get the opportunity of rendering a better service, but I have no recollection of ever having done so; the patients could see no error in the teeth they had and were entirely satisfied. Occasionally, I made a new denture for a patient but only because resorption of the ridges had taken place to such extent that the plates were loose. Upon inserting the new denture the only comment made by the patient was the renewed security of retention. They could eat better because the dentures were secure but insisted that they could eat just as well with the old dentures until they became loose. Similar observations were made in other cases where patients had former dentures made by other dentists where no effort had been made to articulate the teeth. Even a dentist, Dr. H. M. R. of many years

experience, eminent as a prosthetist, and a teacher of prosthetics in one of the leading dental colleges, who had worn artificial dentures for many years, and had had several dentures, some of which were made by eminent specialists, would not say unequivocally when asked whether he could detect any superiority in his last denture in which articulation had been made as compared with former dentures in which occlusion alone had been made. He was not at all certain that he could notice any advantage in his last teeth, his answer to inquiry was "I guess probably they are a little better but it is hard to tell." As a teacher of prosthetic dentistry and teaching articulation too, we should at least have expected more enthusiastic and conclusive testimony from him.

For various good and sufficient reasons I have not as yet been able to make comparative tests of articulation as previously mentioned, however, we may briefly survey the subject which I hope may not be without interest and possibly some enlightenment.

Making artificial dentures is one of the oldest branches of dentistry, yet it has ever been surrounded with more or less uncertainty as to whether results will be satisfactory to the patient. There has been brought forth from time to time first one feature then another as the principal cause of unsatisfactory results. Usually the idea is conveyed that it is this or that particular feature of the work which is the cause of failure. That there may be much difference in mouths presenting for treatment, some being favorable while others are not, is frequently quite ignored, and likewise the nature of the patient. We must have a broader comprehension of this subject and recognize that there are various important factors entering into success or failure of artificial dentures, some of which lie with the patient while others rest with the dentist. Every experienced and observing practitioner knows that there is a vast difference in mouths and it is also known that the disposition of the patient is an important and variable factor wholly aside from the dentists work or the condition of the mouth. No one feature of our work will insure success regardless of other features entering into a case. The problem of artificial dentures is in no sense a mathematical one so that a certain formula will insure definite and positive results.

The subject assigned is articulation of artificial dentures but it should be distinctly understood that the essayist would not convey the idea that this is the most important feature in making artificial dentures. Were a comparison to be made of the relative importance of the different features of artificial denture work, the impression would be given first place; however, articulation is undoubtedly of importance but it is not at all certain that articulation per se is of such importance as has been claimed by some including the essayist.

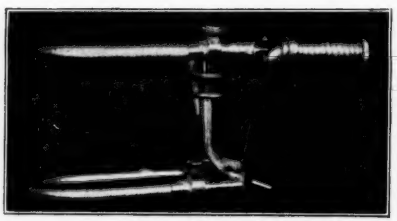
The subject of articulation of teeth in artificial dentures has passed thru various vicissitudes since it was first presented by Dr. Bonwill. The topic is such an extensive one and involves some remarkable intricacies that it is not only impossible to consider it fully in a short discourse, but as previously indicated it is not the intention of the essayist to attempt a full discussion. It is to direct your attention to some questions that have arisen in my experience in this work both as a practitioner and as a teacher.

No one can question the principles of articulation presented by Dr. Bonwill, but all careful observers know that he himself must have fallen short in carrying out those principles in the mouth, in more than a very few and exceptional cases by the use of his articulator, without rearranging the teeth in the mouth, which there is no evidence to show was done. Notwithstanding this Dr. Bonwill seems to have been notably successful as a

prosthetist. At the present time we have in the Northwest two eminent practitioners well known as prosthetists who are using the original Bonwill articulator, rendering highly satisfactory services to their own patients as well as those sent them by other practitioners. We find too that even the most skillful with the latest and most advanced work upon this topic do not always succeed in satisfying the patient. In view of such facts I think we are somewhat justified in questioning the value claimed for articulation.

When Dr. Bonwill gave us articulation of the teeth we were led to believe that the principal cause of unsuccessful artificial dentures had been mastered. He claimed that it was lack of articulation that was chiefly responsible for unsatisfactory dentures. By articulation he meant that there must always be three points of occlusal contact in any movement of the mandible—occlusal contact on each side and on the anterior teeth, not necessarily contact of all of the teeth in all movements of the mandible but occlusion at three different points somewhat like the bearing of a tripod. Only in normal occlusion or occlusion of repose would there be occlusion of all of the teeth.

Figure 1.

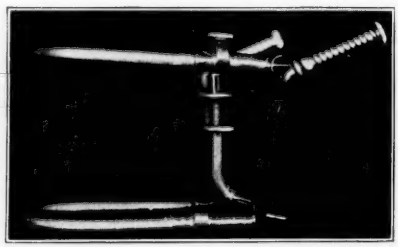


Shows original Bonwill articulator with the adjusting screw post added.

Since that time this topic has received a great deal of earnest study. For many years very few if any were capable of carrying out these principles, in fact very few were capable of comprehending the principles fully and still fewer possessed the technical skill to do the work. One has only to refer to Dr. Bonwill's writings to ascertain the obscurity of his work. It must be admitted however that the topic is one not readily presented to be easily understood.

It was not until Dr. Walker showed us that there was a serious error in the Bonwill articulator which prevented carrying out the principles of articulation in the mouth that noticeable progress was made in this work. (Figs. 1 and 2.)

Figure 2.



Shows Bonwill articulator as modified by the author having condyloid path inclined as found by Walker.

(Slide Bonwill articulator compared with Weiss' modification embodying Walker's discovery of the inclination of the condyloid path.) Walker found that the condyloid path is inclined, and as a result of this there is a downward movement of the mandible on one side when it moves toward the other side. (Figs. 3 and 4, slide with face bars) therefore, articulation made in a Bonwill articulator would be seriously faulty in its most essential feature in the mouth, namely, there would be occlusion upon one side only in lateral movement of the mandible. This is elementary and well understood now by all students of this subject. We cannot but marvel therefore that dentures were said to be successfully used because of articulation when as a matter of fact we now know that the

teeth could not have articulated in any appreciable number of cases.

We may now ask how such teeth could be successfully used if they did not articulate. The answer is simple; such teeth must have been used without

Figure 3.

Shows bars attached to the jaws in normal occlusion, bars being parallel.

lateral movement of the mandible, mere occlusion alone being used. We may here ask also whether this may not after all be the chief or only movement employed with artificial dentures. That there is much evidence to support such view may readily be admitted by the careful observer.

While different investigators have undoubtedly striven earnestly to clarify the atmosphere in the field of articulation, it is a fact that some have only beclouded it. One prominent practitioner who has persistently clung to the original Bonwill articulator, endeavored to prove the correctness of it by mounting casts of the natural teeth so that they articulated correctly. This to the inexperienced would naturally appear as

Figure 4.

Shows mandible moved to the patient's left, the bars now being out of parallel owing to condyle having moved downward on right side.

conclusive evidence of correctness. If, however, we examine the natural teeth carefully we will find that they rarely articulate correctly in all movements of the mandible. For example, in cases where there is an average overbite of the anterior teeth, we will find when the mandible is protruded so that the incisors meet on edge, there is rarely occlusion of the molars. This is a fact that can be easily demonstrated by every one. Now if the casts of such teeth can be mounted

in a Bonwill articulator and made to articulate correctly in this movement, it cannot but seem somewhat mysterious. The mystery lies either in a loose jointed articulator or in the angle at which the casts are placed relative to the condyloid path. By trial the angle between the occlusal line and the condyloid path may be found which will permit articulation. In other words, the casts are mounted at an angle with the condyloid path, which is equivalent to an inclined condyloid path, and when the proper angle of inclination has been found, articulation will follow.

Comment upon this test of correctness of the Bonwill articulator is superfluous.

If we review the subject of articulation and other features of artificial denture construction and present them in a nutshell, we find first that articulation as given by Dr. Bonwill was claimed to be the principal factor in the successful use of artificial dentures. Success however, was not universally met with, in fact, but very few were able to obtain such benefits as were claimed. It must be remembered however, as previously mentioned, that very few felt competent to make articulation because of vague understanding and lack of technical skill, aside from a faulty articulator which at that time was not known.

Next came Dr. Walker who showed a serious defect in the Bonwill articulator and for which reason articulation could not be carried out in the mouth. But even when this error was recognized and correction attempted, successful dentures were not assured.

After that came others notably among whom was Dr. Gysi who did some elaborate research work regarding the movements in the temporo-mandibular articulation. He also confirmed an essential feature of articulation presented by the essayist many years ago in which special emphasis was placed upon the overbite and the length of the cusps in that they should be as short as possible. But still, success in making artificial dentures satisfactory to the patient did not always follow.

Then came Dr. Green with his panacea for the ills of artificial dentures, namely, the modelling compound impression. Articulation was regarded of no value whatever by Dr. Green who referred to it as the "sheep bite" which he had "found of no value." Here too, disappointment was met with for success was not assured.

After this came Supplee with his modification of the Green method of impressions, but the subtle mysteries of certain success were not revealed here.

Recently Dr. Hall came forth with his method of impressions accompanied with unqualified condemnation of the Green and Supplee methods of impressions. Dr. Hall also brought out a new articulator and presented some novel ideas in articulation one of which—the overbite and length of the cusps—is a distinct departure from views quite generally accepted as essentially correct, namely, the overbite and length of the cusps are made decidedly longer than was generally believed could be successfully used. In this too, success in satisfying the patient has not always followed.

In concluding the essayist wishes to present his method of practice and his teaching.

Notwithstanding that, I am not as positive regarding the value of articulation of artificial teeth in insuring successful dentures as I formerly was, I do not wish to be understood as saying it is of no great value. I am frank to confess however, that I do not consider it necessary or essential to obtain the exactness of articulation required in crown and bridge work or other restorative work upon the natural teeth, or the exactness demanded by some in the articulation of artificial dentures wherein the articulation is completed by the use of abrasive

powder in the articulator or in the mouth.

The use of abrasive powder in making articulation in the articulator gives no insurance whatever of the same exactness in the mouth, simply because we have no articulator that precisely reproduces the movements in the mouth; and in the mouth such exactness is not readily obtainable because of the yielding of the tissues upon which the dentures rest. This yielding of the mucous membrane and underlying tissue varies in different cases, but in all cases will readily compensate for considerable discrepancy in articulation. If there were evil consequences—pathologic conditions arising from faulty articulation as occurs in crown and bridge work—or impairment of general nutrition because of faulty mastication, then perfection of articulation would be demanded; but neither of such evils nor other appreciable evils occur with artificial dentures if moderately well constructed.

To obtain perfect articulation in artificial dentures requires much time and painstaking work, which will tax the dentist still further, when it is well known that he is already so burdened in this work that comparatively few feel they can afford to do this work at all, many simply taking the impression and sending it to the dental laboratory for completion of the case.

If we are to expect the dentist to do this work we must give him methods of demonstrable superiority without much additional burden in work and time, otherwise this branch of dental service will be carried on, as much of it is today, by the dental laboratories. It is not my purpose to discuss dental laboratories, but to me it seems quite useless to devote much time in teaching methods that cannot or will not be used by the dentist.

Articulation of artificial teeth has been extensively studied and great emphasis has been given to its importance. Much of this importance is undoubtedly inspired by its significance in crown and bridge work but which as previously indicated, does not apply with equal force in artificial dentures.

No one realizes more fully or feels more keenly than the essayist the stigma of "slacker" which accompanies any doctrine in our work not looking upward toward the ideal, but if consistency is a jewel such accusation will not be made here.

In the College of Dentistry of the University of Minnesota we use the essayists' modification of the Bonwill articulator in which we have a fixed condyloid path of an inclination of 35°. When the teeth have been articulated in the articulator they are always tried in the mouth for correction. It is my belief that until we have an articulator that reproduces exactly the movements of the mandible in every case without an extensive and difficult technic, the only safe way is to test and perfect the articulation in the mouth. We feel that our method is comparatively simple and readily within the reach of dental students, and at the same time sufficiently accurate in its principal features to meet the demands; in other words, our method is simple, efficient and practicable.

Our students make from eight to ten dentures each and with classes numbering from eighty to one hundred members, it affords us ample opportunity for observation. While we do not claim to satisfy every patient, yet the number of dissatisfied ones is exceedingly small.

In addition to a modified articulator which enables us to carry out the principles of articulation enunciated by Dr. Bonwill, we have made two other important modifications of Bonwill's teachings, namely, we make as little overbite as possible, and we set the teeth as nearly over the center of the ridges as is permissible considering of course facial restoration as affected by the anterior teeth.

Dr. Bonwill used an overbite of one-eighth of an inch or even more. While articulation can be made with such an overbite, I consider this impracticable—a point I emphasized in a paper before the Minnesota State Dental Association in 1902 and which has likewise been emphasized by such an eminent investigator as Dr. Gysi—because it necessitates long cusps in the bicuspids and molars which results in such deep meshing of the cusps as to lock them and prevent lateral movement of the teeth. Any attempt at lateral movement results in movement of the mucous membrane and underlying tissue upon which the plates rest, or the mandible slides from under the plate except in cases where there is a very prominent alveolar ridge. In testing such articulation it was almost always observed that the teeth remained locked in attempting lateral movement, instead of gliding over each other as expected in grinding action. Only when the patient is instructed to occlude very lightly in order to permit the teeth to glide over each other is it possible to get lateral movement of the teeth.

With a very short overbite of the incisors the occlusal surfaces of the bicuspids and molars will be comparatively flat thus readily permitting lateral movement as required in articulation.

That long cusps with consequent deep meshing would be more efficient as organs of mastication may readily be admitted, provided the teeth are securely anchored to the jaws, but with such teeth mounted upon plates, the lower of which is usually held in position with very little more force than its own weight it must have been often observed by experienced and careful investigators that such teeth remained in mesh or locked when attempting lateral movement as previously explained.

Teeth with deeply meshing cusps are used however, and successfully, but it remains to be demonstrated that they are used in any other movement than occlusion alone, that they are not used in articulation or lateral movement as can be done with the natural teeth.

It is here where comparative tests may shed some light. It is quite possible even probable that deeply meshing cusps may be more efficient organs of mastication in artificial dentures, even tho lateral movement or articulation is not permissible, than flat cusps which would permit lateral movement.

The relation of the teeth to the alveolar ridge is also an important matter. Dr. Bonwill claimed it made no difference what the relation of the teeth to the alveolar ridge might be, provided the teeth articulate properly and that the arch line ran straight back from the cuspids to the condyles. This involves a question of leverage pure and simple. If the teeth are set buccally or labially from the center of the alveolar ridge, leverage is produced in mastication which tends to displacement of the plates. Tendency to displacement or the amount of leverage depends directly upon the distance the teeth are set outside of the center of the alveolar ridge.

After the teeth have been articulated in the articulator they are tried in the mouth. First of course the occlusion is tested; we must prove that all of the teeth are in occlusion with the mouth closed in normal repose. For this various tests are used similar to those employed in taking the bite, for which one of the best is to have the patient place the tip of the tongue far back upon the palate; this alone however, should not be relied upon. When the correct relation of the jaws has been found we then test the occlusion, not merely by looking at it, but by the use of a thin stiff spatula forced lightly between the occluding teeth and then exerting a rotary action upon the spatula by which we will have opposing force applied to the upper and lower teeth. Usually the teeth will be found in occlusal contact when looking at them but by the use of a spatula as just de-

scribed, we will frequently find that the teeth are forced apart indicating that one or possibly both plates were not resting upon the ridges. When the bite has been correctly taken and the casts properly mounted in the articulator the occlusion will always test correct when trying the plates in the mouth. Should the occlusion be found faulty it of course must be corrected; this will depend entirely upon the character of the error. Usually the error will be that the teeth are too long or too short upon one side. This is quite easily remedied. If there is error in the labio-lingual or bucco-lingual relation of the teeth it may be necessary to take the bite anew and articulate the teeth again.

After the occlusion has been tested the lateral movements and the protruding or incisive movement are tested in similar manner. Testing and correcting articulation in lateral movement can best be shown by a special chart or model devised by the essayist and used in his work as teacher. Figs. 5, 6, 7, 8, and 9.

Figure 5.

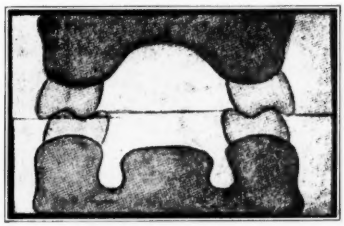
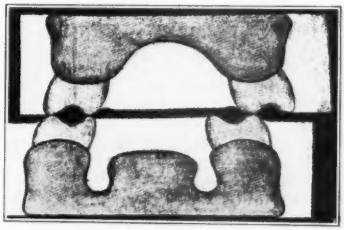
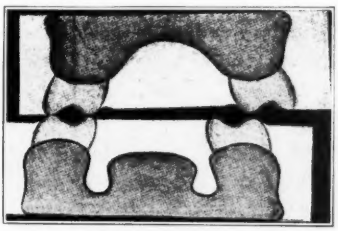


Figure 6.



This shows occlusion and articulation in the Bonwill articulator; also shows that buccal and lingual cusps of both sides are in a straight line or on a level plane.

Figure 7.



This illustrates what we find in the mouth, with teeth having been articulated in a Bonwill articulator when the jaw is moved to one side. This representing the mouth viewed from the front, it will be noticed there is no contact upon the left side—jaw having been moved to the right. This lack of contact is due to the cusps being in a straight line, and the jaw having lowered upon the left side as it moved to the right. Had the lower buccal cusp been longer than the lingual, and had the upper lingual cusp been longer than the buccal, as in Figure 9, contact would have been maintained upon both sides as in Figure where the lowering of the jaw has been the same as in this.

In testing the protruding or incisive movement we must remember that the curvature in the occlusal line—the compensating curve—must be in agreement with the inclination of the condyloid path and the overbite. If in protruding the mandible we should find that there is incisal contact only it signifies that there is insufficient curvature in the occlusal line—insufficient compensating

curve. To increase this we usually find that it can be done by changing the position of the second molars alone—making the curvature more abrupt or the arc of a smaller circle. Should we find in the incisive movement of the mandible and corrected in the mouth it is perhaps needless to say that the plates should not be returned to the articulator, for the teeth will not articulate there if alterations were made in the mouth. Should the plates be returned to the articulator

Figure 8.

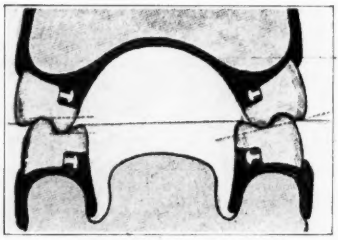
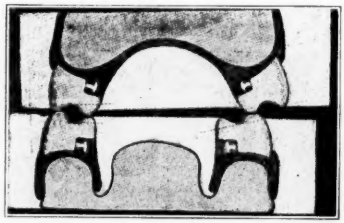


Figure 9.



This represents occlusion and articulation in a modified Bonwill articulator; also illustrates the **inclination** of the **occlusal surfaces** of the molars. In Figure 9 upon the left side (viewed from the front same as looking at the teeth in the mouth) it can be noticed that the **long buccal cusp** of the **lower** opposes the **long lingual cusp** of the **upper,** in this way compensating for the lowering of the jaw upon this side (the left side) as it moves to the right.

Figure 10.

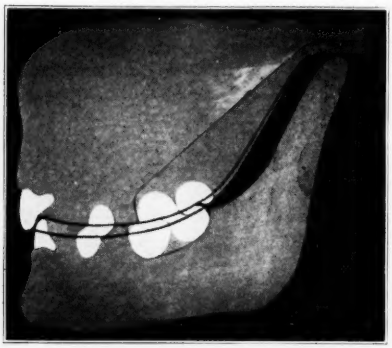
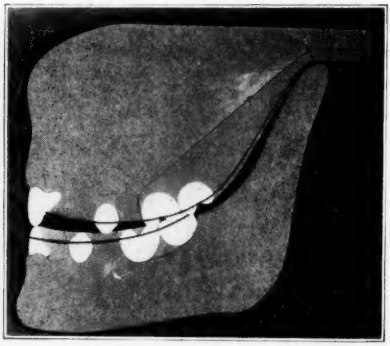


Figure 11.



Show the compensating curve in the occlusal line as required in the Bonwill articulator.

that there is no incisal contact—that there is molar contact only—then we know that there is too much or too pronounced a compensating curvature; the curvature must be made flatter. This too can usually be done by changing the second molars alone. Figs. 10, 11, 12, 13, 14, 15, and 16.

After an articulation has been tested great care must be exercised not to disturb the articulation made in the mouth. Unintentional shifting of the teeth may easily be made when plates are returned to the articulator.

In closing I wish to say again that none is more conscious than the essayist of the many omissions in this paper. None but those well versed in the subject

of articulation can appreciate how difficult it is to speak volumes in this work with a few words; it is simply impossible to do so.

Figure 12.

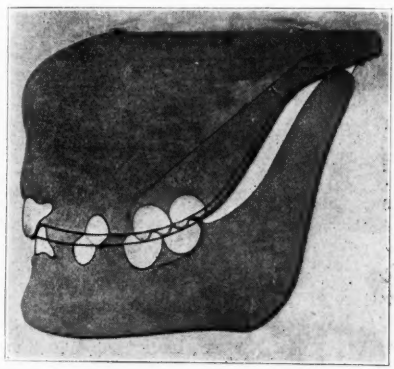
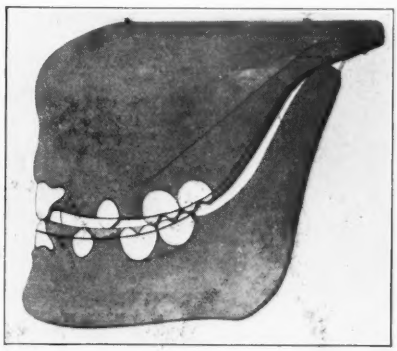


Figure 13.



Show that the compensating curve in figures 10 and 11 is faulty when placed in the mouth and the mandible protruded, the molars in figure 13 not being in occlusal contact because of the downward movement of the condyles. The compensating curve plays no part with the teeth in normal occlusion as shown in figure 12, the occlusion being the same as in the articulator.

Figure 14.

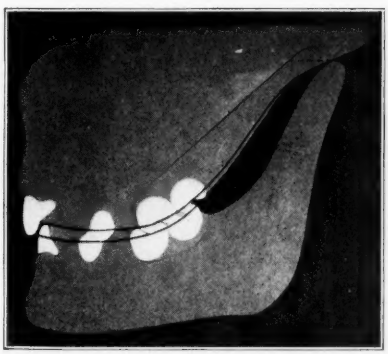
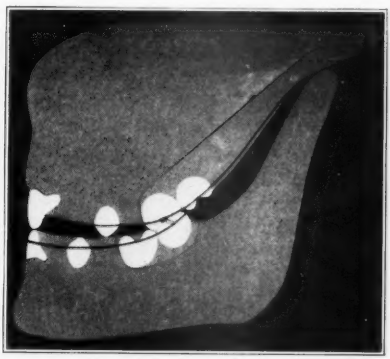


Figure 15.



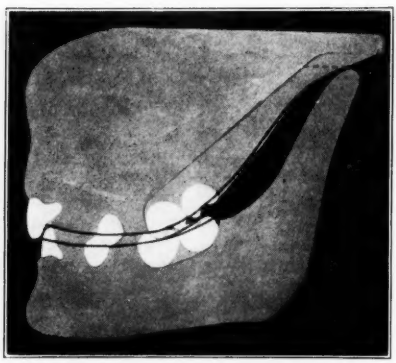
Show the compensating curve of the occlusal line in an articulator having an inclined condyloid path, and in the mouth it will be found the same—shows incisal and molar contact when the mandible is protruded.

To those not thoroly familiar with the subject of articulation of artificial dentures this presentation will probably fall short in its mission. It should be remembered however, that the mission of this paper, as stated in the beginning, was not intended to be a full consideration of all the factors concerned in articulation of artificial dentures.

A lucid discourse upon this topic for

those not having the matter well in hand requires a very lengthy paper and much illustrative material, and even then, no small amount of mental exertion is necessary on the part of the auditor in order to comprehend fully. For the benefit

Figure 16.



Illustrates the difference in the compensating curves made in articulators one having a horizontal condyloid path as in the Bonwill articulator and the other having an inclined condyloid path, the overbite being the same in each case. It will be observed that a more pronounced curve is required with an inclined condyloid path, as shown by the line passing thru the upper molars compared with the line passing thru the lowers.

of those who are not thoroly familiar with the subject of articulation it is hoped that the discussion may give them further light.

Discussion.

Dayton Dunbar Campbell, Kansas City, Mo.

In contending for the adequacy of the Bonwill Method, Dr. O. A. Weiss gives the following unique definition of success: "When I began articulating teeth, some twenty-five years ago, it was by the Bonwill Method, using the Bonwill anatomical articulator, and I am frank to say I met with success, success in satisfying patients because they believed what I told them, not that I demonstrated the truth to them or to myself. They simply took it for granted that the teeth made for them were all right because I said so, and I felt that I knew they were correct."

I should say rather than the goal towards which the modern prosthetist is striving, in the construction of artificial dentures, is the highest degree of efficiency obtainable.

Success with the prosthetist means the best he can do in the light of the most advanced theory and practice in his profession. I demonstrated at the last session of this Association, in New York City that the occlusion regarded as successful by Dr. Weiss is not at all equal to that which has been obtained by the newer method which I am advocating.

I say "modern" prosthetist and refer to the "modern" prosthetist's idea of success because there is rapidly being distinguished in this branch of our profession two well-defined lines of procedure, with special reference to the mechanical alignment of artificial teeth upon the ridges of edentulous mouths.

The first of these two lines of procedure, as followed by those of the old school, who maintained, as does Dr. Weiss, that the temporo-mandibular articulation with its four condyle paths, and two rotation points, together with an action of the muscles of mastication, termed "habitual," play with the all-important part in the movements of the mandible from the time the two opposing cusps of the teeth touch until the final triturating movement. All, of course, of both schools, concede that, until these opposing teeth touch, movements of the mandible are of no practical importance.

Those of the other school, the modern maintain that the foregoing contention is fallacious, for the reason that *the tactile sense of the tooth cusp is the guiding factor in the movements of* the mandible. That the guiding factor is the tooth cusp, and not the cam-like movement of the condyles over the emi-

nentia articularis, may be clearly shown, to those who have eyes to see and ears to hear, from every viewpoint—embryological, evolutionary, anatomical and practical, as was brought out in my paper, and the discussion following, at the New York meeting. This paper was published in the March Journal.

For years, I held the old-school views, and followed, in my technic, those men whom Dr. Weiss mentions, particularly Dr. Alfred Gysi, and I am greatly indebted to them for their teachings and for the inspiration from them thru personal association and the reading of their articles in the dental journals. I have no disposition to minimize their efforts or to speak disparagingly of their work when I say that I have come to see that they had "the cart before the horse," and that they were fundamentally wrong in their belief that the condyles play anything more than an incidental part as a guiding factor in the movements of the mandible.

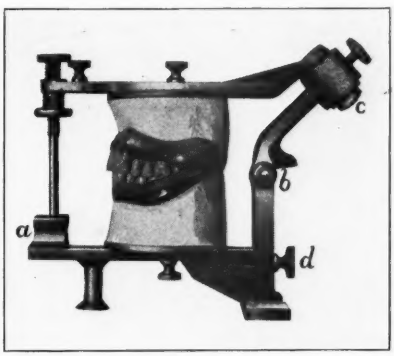
The credit belongs to Dr. Rupert E. Hall, of this city, for constructing an articulator which meets all the demands of the modern school, who hold that the tactile sense of the tooth cusp is the guiding factor in the movements of the mandible.

I have yet to see any man who has ever used one of Dr. Hall's articulators, and who has followed his teachings, that was not convinced that this new idea is correct. I do not mean to say, of course, that all who are interested in prosthetics have accepted Dr. Hall's teachings.

Those who have not accepted them, however, have not, I contend, given them a fair test. Herbert Kaufman says, "Men fail oftener than ideas." That which is perfectly feasible may, in the case of a particular individual, fail completely, thru lack of understanding, thru lack of skill, or of patience in the practical working out of a usable principle. Unfortunately the S. S. White Dental Manufacturing Company seems to be unable to supply adequately the demand for the Hall Articulator.

After thoro and repeated tests, I am convinced that Dr. Hall is right in his principle, and that history will accord to him the honors which are due to the individual who runs the last difficult lap of a relay race to an important goal. I do not wish to laud any individual unduly. Dr. Hall, himself, has repeatedly acknowledged his indebtedness to his predecessors, but at the same time, he is entitled to credit for an important advance in dentistry.

Figure 1.



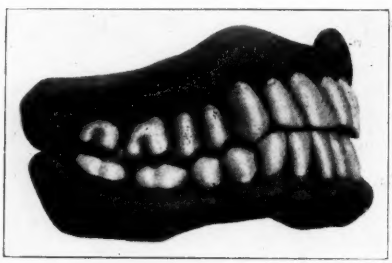
I may say here that I am particularly indebted to our essayist, Dr. Weiss, by reason of the fact that he once asked me a question, when I was a guest of the Minneapolis Dental Society. He asked me the following question: "What becomes of the three-point contact when the bolus of food is placed between the teeth?" I was compelled to be evasive in my answer. I was stumped. But Dr. Hall has solved the problem for me, and for all of us, with his articulator.

The Hall articulator may be described as a large universal joint, capable of producing any movement of the mandible. We have here, in figure one, a Hall articulator. The angle of the cusp is ar-

bitrarily determined by the guide cusp at (a). The opening and closing movement is at (b). The lateral movement is at (c). The antero-posterio movement is connected with the screw at (d). This forward and backward movement is new in articulators, and permits an arrangement of both the six upper and the six lower teeth to a most effective incisive action.

The teeth as shown in this figure, set up in accordance with the general principles given us by Dr. Gysi, but here for the sake of emphasis, greatly exaggerated, are ground up, with deep cusps

Figure 2.



and long overbite. In figure number two we have a closer view of the teeth in lateral occlusion. The mesial facet of the upper cuspid is in contact with the distal facet of the right lower cuspid, while simultaneously the disto-lingual cusp of the left upper molar is in contact with the right inner surface of the disto-buccal cusp of the left lower molar.

Thus you will see a space is provided for the bolus of food which maintains the third point of contact to final occlusion. Here you can put the handle of a spatula in between the teeth and still have the final occlusion of the teeth correct. This is a distinct departure from the Bonwill articulator and its development by Dr. Gysi. I shall show three practical cases in the clinic Thursday morning. I shall then endeavor to prove to you that I am in harmony with one of the demands made by one of the sections that "evidence, not opinions, be submitted." For my part, I should be glad to adopt this phrase as the motto of our prosthetic section.

I am in complete accord with Dr. Weiss' statement: "Clinical tests must determine the value of a theory or method of practice." I may add that there is no procedure in dentistry for which it is possible to have a more standardized technic, after the impression is taken, than in the construction of full upper and lower dentures.

In fact, by the Hall method of articulation, where the porcelain teeth are finally ground, with the No. 90 carborundum grit, using glycerin as the vehicle, to a synchronous and harmonious relationship, it is possible to construct one complete full upper and lower set of dentures which may be worn with equal facility and chewing efficiency by different patients, provided, of course, that substitute bases are employed.

F. A. Frahm, Los Angeles, Calif.

In the discussion of this interesting paper by Dr. O. A. Weiss, I wish first to express my appreciation of his paper, knowing that it was prepared in response to an eleventh hour request and at the close of a hard year of college work. The essayist has given us food for thought and several good suggestions.

The paper to some extent reminds me of the words of Carlyle: "Nothing that was worthy in the past departs; no truth realized by man ever does or can die." But it is a great consolation to us to know that no period of time ever holds all the truth, and that every generation will have the privilege to add to that which has been brought to light. Still greater is the thought that we may have the privilege to discover other truths even greater than those that are now familiar to us. If Drs. Bonwill and Walker had spoken all the truth that there was to be said regarding prosthetic articulation, I

would be willing to accept as fact every statement made by the essayist. To take the work of these two men, however helpful it has been, without reaching for those things that have been brought forth since their day, would place one in a somewhat questionable light and open to criticism, tho it may be unjust.

I am aware of the fact that there have been many men who have wrought a work —unappreciated in their day—that subsequent years have not been able to set aside. I want to ascribe all honor to the men who have labored and laid the foundations upon which we have been permitted to build. Long may their memory live in our hearts and in those of the generations to come.

In the opening paragraphs of the paper the essayist conveys the thought that it matters little how the teeth are articulated, whether it is according to Bonwill's technic or that of later methods; that it is hard to tell if the latest methods offer any advantage over the Bonwill method; that as a whole, the patient will have to get used to the thing and cultivate an artificial bite. My personal experience has shown me that no such happy condition awaits the prosthodontist after the dentures are once in the patient's mouth. If the articulation is faulty, try as he will, he will have to grind and grind, until there are no cusps or articulation left. The patient by this time becomes disgusted and puts up with what he has, or tries another man. The impression is a very important feature; so is the correct relationship between the two arches; but the most important of any of the steps, is the articulation. Without it the case will be a failure, no matter how successfully the other details have been carried out.

"The over-estimated features" the essayist refers to must evidently be those that have been brought forth in the recent past, such as rotation points, condyle tracings and variations in types and sizes of triangles commonly recognized as valuable guides and factors in the problem of articulation. We must not forget that these features have been the logical outcome of careful study and research. There may be a difference of opinion regarding their relative value and application, but very little doubt regarding their adoption as fundamental factors in articulation. These features may be slightly over-estimated, yet there is very little doubt in the minds of most prosthodontists regarding the attitude they should take relative to the features that are advocated by Dr. Gysi and others. Let me say, I have been trying for three years to buy a Gysi Adaptable Articulator, and thus far have been unable to get any one to part with theirs.

The problem of articulation will never be solved as long as we attempt to do the work with the teeth, without recognizing their definite relations to the other several parts of the masticating machine. We must make a thoro study of the anatomy and movements of the temporo-mandibular articulation in both the young and old living subjects. This can be done by the aid of a good face-bow to mount accurate casts upon an articulator that will mimic as nearly as possible each individual case. Then, by carefully studying the facets of the inclined planes of the teeth, we can arrive at some real conclusions regarding the articulation of that case, and what should be the articulation of an edentulous case that has the same anatomical features. I would also suggest that each prosthetist make a number of comparative studies in articulation of the cadaver. If the results of these observations are then tabulated and published, we shall have some very valuable data that will go far toward success in the most difficult of all the fields in which we are called to work. It will remove articulation from the field of empiricism and place it in that of rationalism.

It has been my privilege for a number of years to follow such a course of

study. It has enabled me to arrive at some conclusions regarding articulation that are at variance to those set forth by the essayist. That there exists a very definite relationship between the several parts of the masticating machine, is well beyond the point of theory and quite within the realm of fact. A casual observation of the teeth in the mouth of most humans will reveal the fact that the articulation must conform to certain anatomical and fundamental relations, or the teeth will wear at the expense of centain cusps or inclined planes, or else take an irregular position in the arch. It will not take a great deal of mental gymnastics on the part of any of us to realize that a mandible of the scalene type of triangle, whose base—from condyle to condyle—measures 140 mm, would have to have a different type of articulation from one of the equalateral type measuring only 100 mm on its base. The larger the triangle—other factors being the same—the more flattened will be the arcs upon which the teeth are articulated.

I am glad the essayist has called our attention to the variations in the degree of inclination of the condyle path. Also that he has seen fit to modify the old Bonwill articulator by making it record the average degree of inclination for both sides of the articulator. That is one commendable step in the right direction. If there is an average there must of necessity also be a mean and maximum inclination for the condyle path of some patients. Then if we want to serve these patients by giving them the best articulation possible for them to have, we must take account of these variations or give them a make-shift upon which they can never hope to really masticate as they should.

It is only a year ago that Dr. Campbell in an essay before this body, tried to set at naught every thing that has been laid down as fundamental principles for correct articulation. Fortunately, there are not many men who agree with Dr. Campbell's theories. Those who did, I think, were men who were looking for an easier road to travel, and not for the best interests of prosthodontia. Dr. Campbell in defense of his stand, said, "It is because the tactile sense of the tooth cusps is the guiding factor in the movements of the mandible." If the mandible moves only in such paths as can be permitted by the inclined planes of the teeth, regardless of the inclined path of the condyle, and several other factors entering into the problem of articulation, why do so many cuspids, and some times other teeth, lose a portion or all of the cusp? Please note the worn facets on many of the incisors, and some of the other teeth, and then ask yourself the question: If teeth can be arranged or set up, on the base of a denture or in the mouth, by the crown and bridge worker or orthodontist, without regard for their relationship to the other parts of the masticating unit, why do we not return to the old plain line or hinge articulator? Why not throw away the Bonwill with all its modifications and the later devices that have been brought forth, and tell the men that have labored so long and hard, that they have spent their lives in a useless effort; that all that has been written and said along this line of work was misdirected energy?

On the other hand, if there is need of a Bonwill articulator for this work, there must be truth in what has been said and done, and rather we should raise the banner on whose folds is emblazoned the letters, "EXCELSIOR."

If tactile sense of the tooth cusps is sufficient to guide us and the patient aright, and the articulating device is of no real consequence, there is no articulation problem. Still, most of us here know from our own experience that this problem is very real and should be solved, if that is possible, within our day.

In these days the armamentarium for

extracting is no small part of the equipment of an operator. However, who is there among us that wants to discard all that has been brought forth for our aid and return to the old turn-key? History tells us very plainly that this instrument of a more barbarous age in dentistry was nevertheless a very efficient extractor. Such praise, however, cannot be sounded in favor of the older types of articulating devices.

The essayist refers to a very annoying feature so often encountered after the teeth have been articulated, that of the tipping up of the heel of the mandibular denture during certain movements of the mandible. If it is true, as he says, that there is no real lateral movement, which in a very large percentage of cases consisted principally of lip movements, and that many of the dentures were and are used with only an occlusion function, why should we worry about the articulating problem? It would then matter very little as to what the arrangement of the teeth might be as long as they look well in the mouth. It would then be of little consequence to us or the patient, whether the inclined planes of the cusps met at an angle of 60° or 120°, or whether the teeth were those of the human type or those of the carnivora. In fact, the latter type might prove more efficient because of their cutting or shearing value.

My personal experience in practice and observation of a large number of cases in experimental and clinical work, has established in my mind the necessity of attention to the details that have been questioned and thought non-essential. It has enabled me to come to the conclusion that there is just as definite a position for the last molar on either side of each arch as there is for the right and left central. From the articulation standpoint these molars should be placed with a great deal more accuracy in their predetermined location than the centrals. If the other details are then taken care of, our hardships in articulation will be reduced to a large extent. Then there will be no rocking of the dentures, or torsional strain upon the bridge work, and the retention problem of the orthodontist will vanish as the fog before the noonday sun.

In conclusion, I think I am justified in saying that articulation is just as much a problem to the crown and bridge worker or the orthodontist as it is to the prosthodontist. Neither of these three branches dare for a moment to assume that they may perform their operations on the basis of the existence of an artificial relationship existing between the mandible and the two maxillas, or that such a relationship may be established on the presumption that no matter how much they ignore certain fundamental factors, Nature will step in and harmonize everything, to bring about a desirable conclusion.

George H. Wilson, Cleveland, Ohio.

I think we must feel very grateful for the presentation of this subject as we have had it given to us here today. The paper certainly shows that it was the product of the mentality of age and experience. It was not an impromptu affair by any means, but it was a statement of the conclusions that the author has arrived at after long and thoro study. It simply shows that we have not yet agreed upon different methods, that there is much for us to learn.

The discussers have taken two sides. And that is exactly what I think we have at the present time, two sides or two schools of thought. That the old school shall go out at once is not to be expected. That the new school can be right altogether is not to be expected, because this is a progressive age, and we are continually growing.

If I were to make an epigram on the paper which has been presented, I would say: that the problem of articulation, the mounting of artificial teeth is

mental rather than instrumental (applause.) We must first understand the underlying principles of the anatomy, and the physics involved and then a man can use his favorite instrument in developing the points as he understands them.

It is undoubtedly a fact that Nature comes to our assistance grandly. The various methods and ideas that we have had for years back, with all the different anatomical forms which seemed to serve the purpose was possible because we have a compensating joint in the temporo-mandibular joint.

That calls our attention to the fact that we have had a wrong conception of our anatomy. We have considered the mandible as a lever of the third-class.

If you will read the paper of Dr. Prentiss, the anatomist of Iowa University, in the June number of the Cosmos, I think you will see strong evidence that we must throw up that idea of the lever of the third-class. If you desire me to name the function, I will say that it is a mill, that we use a lever of the third-class to a certain extent, and also the lever of the second-class, as a nut-cracker; but it is a mill, and that the important part is the teeth. If you will follow the subject further and study the muscles you will find that they have an up and down movement. This is demonstrated by the parallelogram of forces, and shows that the stress or working part is upon the teeth and not upon the rotating center on the condyle as in a lever of the third-class. Dr. Prentiss has shown, altho that was not the subject of his paper, the effect that the pressure would have upon the interfibrous cartilage by comparing it with the knee joint, showing that if it was a lever of the third-class, that that cartilage (the meniscus) would be destroyed; and he pointed out that that is exactly what occurs in old age, when the teeth are lost.

It calls our attention to the necessity of keeping the molars in place, either natural or artificial. And when the artificial dentures are made, the pressure should come upon the molars and not upon the condyles.

That calls our attention to the use of the ligaments. I will not take the time to go into that subject, but I want to simply call to your attention that now is the time that we have to study this subject from the foundation up, know our anatomy, not as general anatomy, but as applied to dentistry, the bones, the action of the muscles and the ligaments as well. Prosthetic dentistry is a great study. I am happy to say to you that there is a study club being formed of the plate prosthetists that I hope will be of great benefit to this organization and to the profession as a whole, in comparatively a short time; but we can not expect to reach perfection in any definite time. If we do, then we are dead, because we stop growing. We cannot stand still; so we must expect that this growth will be gradual.

I feel very much encouraged when I see such an audience interested in this subject, as this audience seems to be. There is no question but that prosthetic dentistry is coming to the front. When we know that it is dangerous to keep pulpless teeth in the mouth, is not that knowledge going to be the death blow to crown and bridge work? Is it not going to make a tremendous demand for plate work? Is not the terrible conflict going on in Europe producing such terrible wounds of the face and mouth going to make a great demand for restorations? I say to you, gentlemen, the thing for us to do is to prepare for the future in this line of work, and I believe you are interested in it. I thank you. (Applause.)

O. A. Weiss, closing the discussion: In closing this discussion I shall not detain you long. This magnificent audience and the keen interest exhibited as shown by all having remained here thruout this insufferably hot afternoon is a

glowing tribute in which I feel the utmost pleasure.

One of my objects in presenting this paper was to bring out a free discussion and I believe you will all agree that in this success has been attained. Personally I feel deeply grateful to the discussers even tho some of the discussion did run somewhat awry.

The close attention given here this afternoon by this large assemblage of dentists is sufficient evidence that the dental profession is deeply interested in the subject of articulation of artificial dentures, due no doubt to the great stress laid upon this topic for many years, in view of which it may be noted in passing that it required no little temerity to raise an issue. It is evidence too that with all of the enthusiastic efforts made by different members of our profession during the past twenty-five years in artificial denture construction, one emphasizing one feature while another emphasized some other, some of which were diametrically opposed, the general practitioner however, still feels certain deficiencies and with good reason still yearns to know how he may meet with more certain success—why his service is wholly satisfactory in one case while in another it is not, even tho he has worked just as faithfully.

I have endeavored to show you that success in artificial denture construction is not dependent upon any one feature alone of our work, and I have also tried to show you that one feature of this work, articulation, is not beyond debate in its relative importance, that there are some very valid reasons to doubt that articulation per se is of as much importance in artificial dentures as has been claimed, that there is good evidence to show that it is occlusion principally which is used in mastication with artificial dentures.

Enthusiasm is a good thing but not infrequently we find that it obstructs vision, consciously as well as unconsciously. Those who gave careful attention this afternoon will have understood that I merely presented some questions of articulation which I consider open to debate, and which have not as yet been conclusively answered. I did not imply that my views were conclusive, in fact it was very clearly stated that certain important data is not yet at hand. It was merely to show you that there are differences in the methods of producing articulation tho in principle they are presumed to be identical.

No one in this room has spoken with greater force today than did Dr. Bonwill in his days, yet we know now that he was in error. There probably are not many here who saw or heard Dr. Bonwill. Dr. Wilson here has heard him and there probably are others. Any one who heard Dr. Bonwill felt that he had the gospel in his hand and knew whereof he spoke. While he spoke with great force or positiveness he was not at all successful as a teacher because he invariably injected a strange fancy of geometry—the equilateral triangle—into his presentations thus beclouding the subject and leaving his auditors in a state of confusion. He felt very great regret because he did not succeed in presenting his ideas upon articulation so that the profession could comprehend them and make articulation according to his principles.

I too may say that it is with some regret that my paper was apparently not sufficiently clear to be understood by some of the discussers, tho I made very earnest effort in the brief time at my disposal to prepare a paper that might be understood. As stated in my paper, this subject is by no means simple, yet I must say if the discussers had read the paper with as much care as was exercised in its preparation, there would have been less misunderstanding and less misinterpretation. In the discussion I am charged with having said things which I did not say. Allowances can readily be

made for such errors when one has not had an opportunity to read a paper, but a discusser who has had ample time to read a paper and know and understand what has been said is quite another matter. While a spirited discussion adds zest to a paper, I think it is unfortunate that one's viewpoint is not properly understood before seeking to discuss it because there seldom is time enough to make proper corrections. This simply illustrates too how easy it is to be misunderstood, even by those recognized as authorities, in this complex problem of articulation of artificial dentures, and emphasizes too why so few of the general practitioners aim or succeed if they do try, to use a difficult method of practice especially when there is no positively demonstrable superiority of service.

It seems to me that it ought to have been easily understood by the first discusser that my remarks anent my early success with the Bonwill articulation was merely a frank confession of a delusion I experienced in my early days. If I read the signs aright he too has experienced delusions and it may not be a rash venture of opinion that he will discover others in due time. He also indulged in some humor over the situation presented by my paper that he did not know whether we were going or coming, or something to that effect. I believe the situation is not without some justification, for until the question of articulation is more positively answered than it is at present, the careful observer finds no satisfaction in doing a thing simply because some one says it is the best, or the only proper thing to do. If we take a broad, comprehensive view of the entire problem, and examine all of the evidence pro and con, we must admit great doubt regarding certain claims set forth by some, which cannot be brushed aside by mere rhetoric or oratory. It is wholly unnecessary to repeat here the evidence and the arguments which were amply set forth in the paper. The first discusser made a most remarkable statement, which I should challenge, regarding an articulation made in a Hall articulator, which he claimed would operate in any mouth. This is indeed a strange statement and if it can be actually demonstrated it is deserving of careful consideration. Possibly the day of "ready made" teeth may yet become a reality.

Dr. Frahm said that I claimed we do not get lateral movement in articulation of artificial dentures, that it is only lip movement. I did not say that. I referred to what was done in articulation as practiced by Dr. Bonwill and those who attempted to follow his teaching. He made a long overbite of the teeth and consequently long cusps. Dr. Hall says he never had seen any long cusps in artificial teeth, perhaps in the sense that he uses the term cusp he may not have seen any, however, the equivalent of cusps was made by grinding the teeth. The deep meshing of the cusps as ground in the Bonwill articulation locked the teeth in occlusion and thus almost entirely prevented lateral movement; especially under masticating stress, when lateral movement was attempted it was usually lip movement only. I did not say that this is what I am doing at the present time in my practice or my teaching. I said in my paper that we make a very short overbite consequently have comparatively flat surfaces in the bicuspids and molars thus permitting lateral movement of the teeth to take place very easily.

Dr. Hall says that I am standing on the same ground I did twenty-five years ago. I think Dr. Hall must have been wrought up a good deal, rather than a little, as he said, for he certainly did not understand what I said. If I were standing on the same ground, it seems to me that I would be practicing and teaching Bonwill articulation. I doubt that there is any one else in the audience who got this understanding from my paper, if

they did I should want to take the time to correct them. I shall not therefore dwell further upon this statement. Dr. Hall and Dr. Campbell tell you that the condyloid path plays no part in the articulation of the teeth, that it is the cusps that control the movement of the mandible. If this were true, why is it that in the incisive position of the natural teeth—as mentioned in the paper—we rarely have molar contact if there is any appreciable overbite of the incisors? This in itself ought to be sufficient proof of the fallacy of their statement. If we examine the temporo-mandibular articulation, we find that in the main it is like all other articulations; it has the characteristic articular surfaces, an inter-articlar cartilege and synovial membrane, indicating definite movements, tho of considerable range. If this does not control the movements why has nature provided these elaborate structures?

If we place a piece of cardboard between the molars as in mastication upon one side, the molars upon the other side will not be in occlusal contact; if the temporo-mandibular articulation plays no part in the articulation of the teeth we should expect molar occlusion upon the side where no cardboard is placed. Dr. Hall will not claim that there would be molar occlusion on the side where no cardboard has been placed, but he should tell us *why* there would be no such occlusion if, as he claims, the temporo-mandibular articulation does not guide the movement of the mandible. I should like to know what evidence Dr. Hall and Dr. Campbell have for their claim that the temporo-mandibular articulation does not guide the movements of the mandible. Dr. Hall's illustration of the "rails on the rail-road guiding the wheels," which seems to have been accepted as proof by some here, is no evidence at all that the cusps alone guide the movements of the mandible even tho the cusps were ground to articulate in a Hall articulator. If this were true, as they contend, then it should make no difference what the cusp formation is for they would guide the movements of the mandible, whether the cusps were ground in a Hall articulator or any other. Furthermore, the rails and wheels illustration is without force in the question under consideration for Dr. Hall himself would not be willing to ride on a train traveling on rails not securely fastened to the earth; in the mouth we do not have artificial dentures spiked to the jaws. I can see how the cusps might be said to guide the movements of the mandible in all cases where we have long cusps with deep meshing, but this would operate by simply limiting all movements the patient might make except mere occlusion —the straight up and down movement of the mandible. This however, would not be articulation of the teeth, the free movement of the mandible in all directions with three points of occlusion in any position the patient might desire in mastication. This feature was discussed at some length in my paper.

There were some other errors in the discussion in which I was charged with saying things that I did not say, but as we have already taken up much time and as there is another paper to follow, I shall not detain you longer. In the published proceedings of this association, the paper and discussion will be found where those interested may read carefully and ascertain just what the essayist has contended for. I thank you for your kind interest and attention. (Applause.)

ORTHODONTIC APPLIANCES AND GINGIVAL TISSUE.

By Alfred P. Rogers, D. D. S., Boston, Mass.

(Read before the National Dental Association at Its Twenty-Second Annual Session, Chicago, Ill., August 5-9, 1918.)

A FEW years ago while attending a meeting of Orthodontists in the city of Washington, I listened to a most interesting paper by Dr. Clyde M. Gearhart, entitled "Abuses of the Peridental Membrane." There were many things in the paper which made a deep impression upon the minds of those who heard it, most of whom for years had been in the habit of jealously guarding the health of the gingival tissues when making application of orthodontic appliances. Nevertheless, the paper was of such character that I believe all the thoughtful men present asked themselves the question, "Is there anything more that I can do to further protect this delicate tissue from injury?" Or, "Is it not possible for Orthodontists to so simplify their appliances that much that was then in use might be discarded?" It was not long after listening to this paper that I began the development of a finer technic with relation to the construction and application of cemented bands; and as a result of this technic the gingival tissues have been less endangered than formerly. I shall, therefore, make it the basis of my paper. Before proceeding, however, I wish to make one quotation from Dr. Gearhart's paper in order to emphasize the great necessity of the greatest care, not only in the proper execution of each step in the process, but also the proper application or cementation and proper removal when the appliance has completed its purpose. In emphasizing the importance of the subject, Dr. Gearhart says, "Anything that causes a break in the continuity of the gum tissue may cause pyorrhea. When the vitality of the peridental membrane is impaired, the life of the tooth is threatened, and by far too many children's teeth are placed in jeopardy by the orthodontist. Bands on the teeth that are pushed up under the gingiva from one thirty-second to three-sixteenths of an inch, as is often the case, immediately indict the operator as being guilty of faulty technic in constructing the bands. Often, when the band may extend just to the free margin of the gum labially and lingually, no provision has been made for the interdental spaces by festooning the band; instead, a band of the same width all around is used."

Altho Dr. Gearhart cited instances which were no doubt extreme in their disastrous results, nevertheless his warning was most timely, and it is with full recognition of the essential truths brought forth that I am tempted to undertake the present writing.

It will be essential for our purpose to make a brief study of the longitudinal section of the tooth in alveolar process of a wet specimen showing the gingival tissue. (Figure 1.) This specimen was made by Dr. F. F. Bates of Tufts Dental College, Boston, Mass., who has kindly loaned it to me for this occasion.

You will see that it presents a very accurate diagram of these tissues, and its careful study cannot but help the thoughtful man in attempting a finer technic both in construction and adaptation of appliances. It also furnishes a guide to him in his selection of appliance forms and methods of attachment. It will, I think, be sufficient for our present purpose to confine our observations to the immediate vicinity of the gingival border, observing the gingival

Figure 1.

pocket, the bottom of which is found at the junction of the enamel and the pericementum, the exact point where the peridental membrane terminates. This point is most sensitive and easily injured. Even slight inflammation at this point serves to destroy the terminal endings of this sensitive tissue. The mucous membrane forming the outer lip of the membrane of this pocket has its form and structure definitely adapted to the protection of the peridental membrane. Any turning back of this tissue destroys its form, interferes also with its function, allowing particles of food or other irritating material to find a way into the pocket, thus, in many cases, setting up an inflammatory process. Carelessly adapted bands, ligatures of silk or wire thrown around the neck of the teeth cannot but influence and destroy its function. This free margin, or cushion, must, therefore, receive increasing thoughtful consideration of the orthodontist when constructing and when applying his various agencies for tooth-movement; and if indeed a break be accidentally made, it must receive the proper treatment before any inflammatory condition can take place.

The vast majority of men undertaking orthodontic work, especially in general practice, are, I believe, totally unprepared in a technical way for the tasks that they assume. It is essential that reeducation regarding this particular phase of the work should be promptly undertaken, so that those in the future who undertake the application of orthodontic appliances shall do so only after following out absolutely scientific methods. We have seen, then, from the study of Dr. Bates's picture, how essential it is that first of all the banding materials shall not extend far enough to cause irritation of the peridental membrane, how essential it is that the band material shall be accurately adapted to the enamel surface, especially at the point where it approaches the gingival tissues. We shall see, too, how essential it is that no overlapping of the soft tissue shall be possible. It is obvious, too, that we must seek to become skilled in the use and application of those forms of appliances which do not call for the use of ligatures. In fact, everything must be abandoned which is apt to prove dangerous, especially with relation to the permanent development. Let it then be a principle that shall be adopted and heeded by all that the construction and adaptation of appliances for orthodontic purposes shall be such that no injury to the delicate tissue shall be possible.

That there is an awakening among

orthodontists resulting in a strong desire to emphasize this very idea of improved technic is supported by at least two articles dealing with this subject. One, written by Dr. C. A. Hawley, entitled "The Use of the Plain Band for Molar Teeth," read before the American Society of Orthodontists, July, 1915. In this paper Dr. Hawley elaborates the principles for a long time used by Dr. Henry Baker, of Boston. A few years later Dr. Martin Dewey read an article on this same subject, presenting an indirect method of molar band construction following ideas from Drs. Hawley, Mershon and Schroeder.

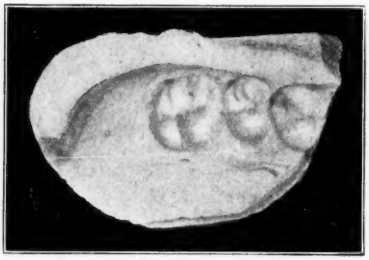


Figure 2.

Since molar band construction is the first essential, for the molar bands are used in practically every case where malocclusion is to be corrected, I feel perhaps that I shall be of greater service to you by presenting the technic which I have already referred to, and which, in my own experience, has proved so gratifying.

The various steps necessary in following this method must be most accurately executed, and if the operator is conscientious he will be rewarded by perfectly fitted and easily adapted bands which are not only painless in their application, but which furnish him also with a certain security and stability which greatly enhances the successful operation of his appliances. I might mention in passing that the technic for the molar band which I am to describe is exactly the technic which may be used in the construction of bands for any tooth which calls for a band.

The tooth which is to be banded must first undergo a thoro prophylactic treatment. An accurate plaster impression is then taken. (Figure 2.) When this has been removed from the mouth, the operator carefully investigates the gingival tissue to ascertain the amount of free margin which is present. This is necessary especially in the treatment of children when the first molar is to be banded, and where there is usually an excess of tissue. Careful note is made of the depth of the gingival pocket, and

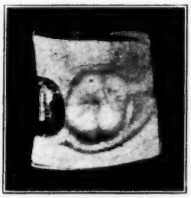


Figure 3.

the operator determines just how far it is safe to allow the margin of his band to slide under the soft tissue, always remembering that he must be a safe distance away from the bottom of the pocket when his band is cemented in place. In young cases the operator must bear in mind that the soft tissues are rapidly absorbed and it must be deep enough to protect the enamel surface when this absorption takes place. The distance the operator intends his band to go under the free margin is indicated on the impression by a pencil mark both buccally and lingually. Before the impression is varnished it is trimmed down to the point indicated by the pencil mark and at right angles to the long axis of the tooth (Figure 3.) The impression is then varnished with shellac and set aside

to dry. When the shellac is thoroly dry, the operator secures a pencil made from modeling compound, which pencil may be made from compound which has been previously used. (Figure 4.) The end of this pencil, having been made free from grooves or wrinkles, is then warmed to a uniform depth, leaving in the center a hard core. On its way from the flame to the impression it is quickly immersed

Figure 4.

in a receptacle of vaseline, the point only being covered. It is immediately plunged into the tooth impression, taking care that the pencil is held in the exact direction of the long axis of the tooth. When sufficiently hard, the compound die is removed from the impression, when the buccal and lingual planes, each standing at right angles with the axis of the tooth, will be seen (Figure 5) and indicating the point at which the carving of the compound representing the soft tissue shall terminate; as already explained, these planes represent the depth below the free margin of the gum tissue that the operator has previously decided that it is safe for the molar band to project. The operator then proceeds to carve away from the tooth surface the compound representing the gingival tissue. This carving must be so carefully done that the enamel surfaces represented by the com-

Figure 5.

pound model are not changed or marred in the least. Mesial and distal carving, the base lines are allowed to curve occlusally (Figure 6) being continuous with the buccal and lingual planes. This surface, which is always carved at right angles with the long axis, is termed the "seat," and, when the carving is com-

Figure 6.

plete, determines the length and form of the gingival surface of the band. Upon completion of this carving, the compound model receives a thin coat of varnish, and when sufficiently dry is inserted into a bed of plaster to which a small portion of sump has been added. When this investment is sufficiently hard, the com-

pound is softened in hot water and very carefully removed from the investment. The investment is then allowed to dry and is later filled with Melotte's metal. I have found that the use of Melotte's metal gives very much better results than amalgam used by Dr.

Figure 7.

Dewey in the indirect method. It is much quicker and gives a better model for working purposes. After repeated trials with Melotte's metal I have found that a much smoother surface is obtained if the operator will, while the metal is in a semi-molten state, carefully tamp

Figure 8.

it down with a plunger made from a very tight roll of cotton. It will be found in following this procedure that the metal presents a smooth, bright surface to which the molar bands can be beautifully adapted. Figure 7 represents the metal die upon its removal from the investment. When this stage is reached the operator may proceed by whatever method he wishes to construct his bands —whether it be swaged or burnished, he must see that it is properly seated and perfectly adapted to the enamel surface, especially at the gingival border.

Figure 8 represents the metal die with

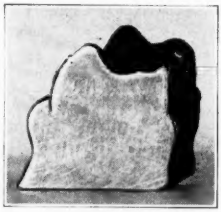


Figure 9.

the band in place. Figure 9 represents a longitudinal section of a molar tooth with the band in place, and shows a band which has been actually in use, the impression being taken with the band in place after more than a year of use. The gingival edges of the band will be seen projecting into the gingival pocket. The free margin of the gum being normal and in perfect contact. Figure 10

Figure 10.

represents the molar band after its removal from the metal die, and ready for whatever attachments the orthodontist wishes to place upon it. This picture is shown principally to give me an opportunity to point out two important points which are essential to correct adaptation. These are the points which dip down to the gingival border buccally and lingually. It will be necessary at this point to think back to the carving of the com-

pound model. Just below the gingival border the surfaces representing the enamel are scraped away both lingually and buccally, so that the buccal lingual is perhaps from one to two-hundredths of an inch less than on the actual tooth. Thus when the completed band is adapted to the tooth, a slight spring takes place which adds greatly to the nicety of the fit. The festooning of the mesial and distal surfaces makes possible this exact adaptation. Perhaps a few illustrations taken from the mouth will serve to show the health of the gingival tissue after bands constructed in this way have been in place for more or less lengthy periods. Fig. 11 represents the

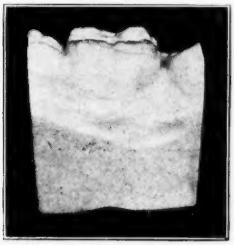


Figure 11.

tooth with the band in place for a period of between one and two years. The study of the gingival tissues in this picture will show the normal state. Figure 12 represents a case where the gingival tissue is slightly pushed back, and one which required careful attention upon the removal of the band. This illustration was taken immediately upon the removal of the band and the treatment consisted of careful prophylaxis and an application of glycerine and iodine. Figure 13 represents the tissue surrounding the deciduous tooth after the prolonged use of an orthodontic appliance. It will be noticed that here is represented considerable loss of the gingival tissue. Had this been a permanent tooth the condition would have been much more serious. The complete change of the soft tissue at this point takes place upon the loss of the deciduous at the eruption of the permanent one, so that no harm was done in this case. This fact is one of the best arguments that the orthodontist has for undertaking his bone stimulating pro-

Figure 12.

cesses during the period when the adaptation of appliances can be made wholly to the deciduous teeth, for slight injuries to the soft tissues during this period are not at all serious when compared with similar injuries occurring around the permanent teeth.

I should like to add a word or two with respect to the cementation of bands for orthodontic purposes together with the treatment of the teeth and soft tissue

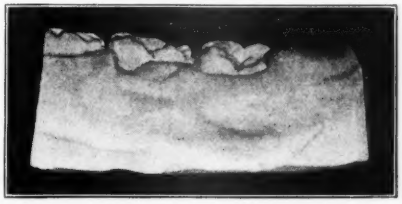


Figure 13.

immediately after the removal of the orthodontic apparatus. The tooth to be banded must of course at first receive a thoro prophylactic treatment following an application of iodine and glycerine. The tooth is thoroly dried and sufficient cement mixed to insure a large surplus. After the band has been pressed

thoroly in place and burnished, care must be taken that every particle of surplus cement is removed. This is better accomplished if the cement is allowed to thoroly harden, when it can be removed in large pieces, leaving no minute particles to work their way under the free margin. If the operator is in a hurry

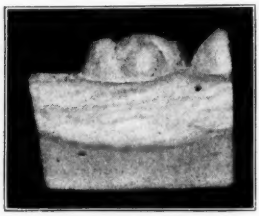


Figure 14.

and attempts to remove the surplus cement before this thoroly hardened state is reached, it is apt to break up into innumerable small pieces, some of which might remain in the gingival pocket where sooner or later it will become a source of irritation. The treatment of the teeth and soft tissue surrounding them should be similar to that given before the bands are cemented. The careful scaling of all particles of cement from the enamel surfaces, the gingival surface carefully tapped and an application of iodine and glycerine made. (Following such technic, no injury to the soft tissue can result.) The prolific source of trouble is often due to carelessness of scaling the cement from the enamel surfaces. (Figure 14.) Small particles may be left just above the free margin and later may become detached and forced into the gingival pocket, resulting in destructive inflammation around the peridental membrane at its attachment.

Question: What kind of band material used and where the soldered seam is placed?

A. P. Rogers, Boston, Mass. (closing): The seam is usually made on the lingual surface. I did not attempt to describe the technic of making the band itself, for almost anyone can develop enough skill to make a good band if he uses the swaging method.

The material does not make much difference. I have used gold and iridioplatinum with good results. Your own experience with these things is the most satisfactory guide; I think it is best to use whatever works best for one, except the base metals.

THE DIAGNOSIS AND TREATMENT OF CONDITIONS RESULTING FROM DISEASED DENTAL PULPS.

By Edgar D. Coolidge, D. D. S., Chicago, Ill.

(Read before Chicago Dental Society, December 17, 1918.)

THE conditions to be considered for pulp treatment begin with the vital healthy pulp which is removed to allow the tooth or root to be used for some mechanical anchorage of operative or prosthetic construction. While the importance of the vitality of the pulp is recognized today as never before, the time has not yet come when all patients can be given the best treatment when they present for dental service, without an occasional vital pulp removal. Such cases should be handled with the greatest care to protect the periapical tissue from injury and to leave the root in such a condition that no future disturbance will occur from unclean materials used or imperfect results. Whatever may be expected of the profession of dentistry in the treatment of the pulp will certainly be looked for in cases having the most favorable history; and unless the best methods of operating at the present time in such cases do not produce a very high percentage of success, we must change those methods or discontinue removing vital pulps of teeth for any purpose whatsoever.

In examining the radiographic records of root-canal fillings inserted in the past, we are able to get a fairly accurate perspective of the status of these operations as a basis upon which to build our future work. When examining radiographs of root-canal fillings inserted in the past, we must take into consideration that there was scarcely ever any use made of the radiograph to assist the dentist to fill the canals completely, and, therefore, a very large percentage of all fillings are imperfect or poor fillings. Another factor of great importance to be considered is that less attention was paid to the necessity of surgical cleanliness than is paid at the present time, and consequently a much larger percentage of abscesses would result from such operations than from similar operations carried on under aseptic conditions. Dr. Arthur D. Black (1) reports radiographic examinations of over 1,500 fillings, which he separates into two classes, showing good fillings in large and small canals, and poor fillings in large and small canals. Of the good root fillings in large and small canals about 9 per cent showed abscessed conditions about the apices, while poor root fillings in large and small canals showed about 63 per cent abscessed conditions. This statement is encouraging to the careful operator. If in the past, without the advantages of equipment and methods of operating now used, it was possible to produce over 90 per cent of success where good root-canal fillings were inserted, it looks as if a reasonable conclusion might be made that *by making all good fillings under aseptic conditions, the difficulties of this problem would be to a very large extent solved.*

The Diseases of the Dental Pulp.

The diseases of the vital dental pulp as recognized today are hyperemia and inflammation. "Hyperemia of the pulp consists essentially in the expansion of the blood vessels, principally the arteries, during any sudden abnormal blood pressure." (2) The recognition of this condition is important from the standpoint of preventive treatment, for usually, by prompt attention to the tooth, further development of the disease can be avoided and the tooth pulp restored to normal condition. The step from hyperemia to normal or to further and more serious disease—namely, inflammation—is very slight. It is very difficult to determine at just what point hyperemia becomes an inflammatory condition. Dr. G. V. Black stated (2) in his work upon this subject that "the result of inflammation of the pulp in the tooth of an adult is practically always the death of the pulp." It is important to recognize and correct this condition to prevent further progress of this disease. When the pulp is inflamed and the prognosis is very unfavorable, it is far better service to the patient to remove the pulp under aseptic conditions and completely fill the canal with gutta-percha than to leave the pulp to die and become infected before treatment is begun. Here, again, is important preventive dentistry, and the result should justify such a treatment.

Dead Pulps.

The dead pulps which present for treatment may be infected or not infected. Where the pulp is dead without infection, the treatment involved is as simple as the one removed by anesthesia. The difficulty in this case is to be sure there is no infection present, and it is usually safe to assume that all dead pulps may be infected. When the pulp becomes infected, the dentin also becomes infected and the problem of overcoming that difficulty has never been satisfactorily solved. Much of the infected dentin in the canal can be removed by the process of curetting and filing while preparing the canal for filling, and certain antiseptics should be used to overcome as much of the infection in the dentin as possible. After careful mechanical and therapeutic treatment, the apical foramen should be sealed and the canal filled completely with a well condensed filling of gutta-percha, which should place the tooth in a reasonably safe condition for the future. However, the presence of collateral branches and multiple foramina, which are often found, contribute to the uncertainty of the future health of the investing membrane, and the tooth containing an infected pulp can never be considered as safe after treatment as one that has never been infected but had its pulp removed while vital.

Periapical Tissue Involvement.

It is difficult to know just when the periapical tissue is first involved with the diseased pulp. Many teeth have infected pulps without any evident involvement of the periapical tissue. The determination of such involvement is based on the evidence found in the radiograph except in cases where swellings or fistula or some visible evidence of periapical involvement occurs. The conditions involving the periapical tissue are abscesses, acute and chronic. The acute abscess does not as a rule involve a sufficient amount of tissue destruction to make the prognosis of the condition unfavorable. Usually after the evacuation of the pus and the removal of the cause—namely, the infection in the root-canal—the condition will yield to treatment. The chronic abscess is of long standing, and there is always more or less tissue involvement in the periapical region. The radiograph shows a difference in the density, which appears as a darkened area in the negative. These darkened areas vary in extent from small

lines and shadows to large hollow cavities in the alveolar process, and contain pus or granuloma or are cyst cavities. Some of these absorptions include the peridental membrane and its attachment to the cementum, leaving a portion of the cementum denuded. The extent of the cementum denuded, which of course becomes infected and soaked with the pus in the cavity, has a great deal to do with the prognosis of the case. There may be absorptions of the root itself, leaving a roughened surface not only infected but such as would become a mechanical irritant in the tissue.

Method of Diagnosis.

In a complete examination and diagnosis of a case it is well to record all the information obtainable regarding both the local and general conditions of the patient. The first examination should be made by observation of missing teeth, crowns, bridges, large fillings under which it is considered doubtful if a normal condition of the pulp exists, and by recording the same. By transillumination or examination with the mouth lamp all teeth not reflecting a normal color should be recorded. While these methods of examination will detect almost every tooth under suspicion, the examination is not complete. By percussion and palpitation, by tapping tooth after tooth with an instrument, and by feeling along the buccal and labial surface of the alveolar process on the gum directly over the root, any inflammation of the peridental membrane or swelling or soreness may usually be detected, and also the dullness of sound of the pulpless tooth may often be detected by percussion and thus recorded. By either faradic or galvanic current the condition of the pulp can be determined to a certain extent, and at least the vital pulps of normal condition can be distinguished from the dead pulps, and a further record of the teeth under suspicion can be made. In the vitality test by the electric current one should first establish as near as possible the normal amount of current required to produce irritation and response, and pass from tooth to tooth, recording as doubtful such teeth as do not respond to the same amount of current. Where crowns or very large metal fillings are present, the electric current is not reliable, since the conductivity of metals is so rapid that irritation would be produced thru the peridental membrane and the same response would be evident as with vital pulp. The irritation point of the inflamed pulp will be lower, and of the pulp undergoing suppuration it will be higher, while dead pulps will not respond at all. Absolute dependence cannot be placed on any of the above mentioned methods of diagnosis, but by a careful application of all these methods one should arrive at a fairly accurate distinction between the vital and dead pulps and record other irregularities of pulp conditions suspected.

The record of irregularities of occlusion and alignment of the teeth should be included at this time as well as the general condition of the teeth as to their susceptibility to and the presence of decay. It should also include a record of the condition of the gingiva and gums and of the depth of detachments of the peridental membrane in the subgingival space—that is, the depth of all pockets usually spoken of as pyorrhea pockets—since the prognosis of the case is dependent upon every condition present within the oral cavity. When this record is complete, there is much valuable data upon which to base the recommendation for treatment after the diagnosis.

The general remarks and history of the case should be recorded. Pathological conditions, if present or recent, should be recorded as: enlarged joints, painful joints or muscle pains, local inflammations of the eyes, nose, throat, or tonsils, such general conditions as anemia, nervousness or fatigue, and organic

disturbances, such as appendicitis, gastric ulcer, gall bladder trouble, or any other condition that might arise from or be affected by local infections in the oral cavity. In many cases even a blood count should be made and blood pressure recorded. Often patients suffering from conditions arising from focal infections have had a complete physical examination, and the physician will usually gladly cooperate with the dentist, and a better perspective of the case can be obtained by such consultation and exchange of examination records.

A complete radiographic record of the mouth is an indispensable asset before the diagnosis is complete. Many of the conditions recorded from the examination thus far will be verified by radiograph. Record of all root-canal fillings can be made showing those which are in a condition to be accepted without treatment and those which must be replaced. Periapical conditions should be recorded as shown by the radiograph. Teeth over which occur darkened areas, rarified areas, and small absorptions may be considered for treatment, and those showing large absorptions, denuded areas of cementum, and large absorptions involving alveolar process and supporting tissue should be considered as beyond treatment in most cases. Many times a darkened area will be found on a radiograph negative directly over the apex of a root involving the periapical tissue. Should the vitality tests indicate a vital pulp, such an area should not be considered as direct evidence of a pathological condition. As a check upon such opposing evidence, it is advisable further to investigate the condition by making a thermal test or by repeating the first tests or in some instances even by resorting to drilling into the tooth to determine the exact condition present. The recognition of such areas depends upon the amount of absorption found by radiograph, as absorption follows the infection which develops within the root-canal in the decomposed pulp tissue. *The dead and infected pulp may be a decided menace* to the health of a patient *before* the area of *absorption appears* to attract the attention of the diagnostician, and therefore, the radiograph should not be relied upon entirely to locate such conditions nor should the involvement of the periapical tissue be determined entirely by the same means. The histology of the cementum shows that, when suppurative conditions exist, reattachment of the peridental membrane cannot be expected, and it is not good practice to carry such cases along under treatment for an indefinite period. There are some cases which show definite absorbed areas which extend into the alveolar process without destroying much of the attachment of the tissue to the cementum. Where there is any evidence that the amount of cementum denuded is small, treatment may be given, and gratifying results will usually follow. However, the case should be kept under close observation for an indefinite period.

The Prognosis.

The prognosis of the case should be based upon the summing up of all conditions recorded together with a consideration of the mechanical requirements for reconstructing and restoring the organs of mastication for safety to health, comfort, and usefulness of function.

The general condition of the patient's health has much to do with the prognosis as well as the local condition of each tooth. More radical treatment should be employed where systemic disturbances are present than where such conditions do not exist. The mental attitude of the patient toward dental operations and the physical ability for endurance of prolonged treatment must be considered as another great factor in the prognosis. The duration of a diseased condition is of some importance, as there is more or less complication attending conditions of long standing and the prognosis of a case

is more favorable when taken early. One should consider the accessibility of the tooth to the operation of treatment and filling of the root and to the operation of root resection where indicated. Resection of the root of single-rooted teeth, and occasionally of one root of a multi-rooted tooth, may be considered where absorptions exist which denudes an amount of the cementum that would make the prognosis of the condition unfavorable without such treatment. A consideration of the value and importance of every tooth individually and to the whole masticatory apparatus as a unit should be given before entering upon a long and costly treatment; and such diseased teeth as can be removed without affecting the value and comfort of the mechanical substitute to replace them, the operator should remove rather than prolong the treatment of the entire case.

The Treatment.

The moment treatment of a tooth is commenced, there is a certain responsibility that must be assumed by the operator. Where a healthy condition exists at the outset, his operations alone will be responsible for the health of the periapical tissue and to a large extent for the life of the tooth. Records of the past show the results of good operations and poor operations, and with the advantages of the present day over the past in the way of equipment, sterilization, and radiography, every conscientious operator should refuse to be satisfied with anything less than the most perfect result possible to be gained. One sometimes hears the statement made that the operator should not anticipate trouble in a tooth that has remained comfortable for years with an imperfect root filling. From such a hypothesis one might reason that, because a tooth has remained comfortable with an imperfect root filling, another will; hence, perfect root fillings are accidents, rather than regular occurrences. *By such reasoning all progress would cease,* and the root-canal situation would be a discredit to the profession. Every operator must set as his standard only perfect root-canal fillings and not be satisfied with less than the very best result obtainable in every case.

Pulp Removal.

The safest method of pulp removal is by local anesthesia either by injection or by pressure. Pulp tissue removed by these methods need not be contaminated with irritating drugs, nor need the periapical tissue be injured from their effects. The use of arsenic trioxid should be discouraged. If arsenic were only used as an obtundent for making possible a painless exposure of the pulp, there would be very much less danger of injury to the periapical tissue. For this purpose it should never be left in a tooth over forty-eight hours and often only twenty-four hours. Drugs for use following pulp removal should be limited to the least irritating anodynes of the essential oils or their derivatives, preferably oil of cloves or eugenol. The root should be filled after pulp removal as soon as all the pulp tissue can be removed, the canal enlarged sufficiently to give access to the apical foramen, the canal dry, and no pericementitis present. This may be at the second sitting, or it may be necessary to extend the treatment over several sittings before the canal is ready for filling.

The Treatment of Dead Pulps.

In the treatment of dead pulps the question of disinfection without injury to the periapical tissue is paramount. The mechanical cleaning and curettement during the process of enlargement is a very great factor in removing infectious organic matter and in scraping out the infected surface of the dentin surrounding the canal. Regardless of the condition of the periapical tissue, the process of disinfection is the same

and should be treated in the same manner. Highly irritating and caustic drugs should be used with the greatest of care, if used at all, and since results may be accomplished without their use, it is most advisable to resort to the less dangerous drugs. Formalin or any preparations containing it should never be allowed to come in contact with live tissue. Where the apical foramen of the canal is sealed by some substance which prevents contact of the drug with the periapical tissue, formalin may be used with a less degree of danger, but it should never be used for more than one treatment. Phenol is very destructive to the soft tissue, and if used at all, should be used with extreme care. After the canal has been thoroly cleaned mechanically, there is less need of strong antiseptics. Beechwood creosote may be used without injury to the tissue and with entire satisfaction.

Chlorin has come into great use as an antiseptic and disinfectant for infected wounds. In the past the chlorin solutions proved too irritating to the tissue and too unstable in solution to be very widely used, but since the latter work of Dakin and Carrol and others on this subject we are given a solution that can be used to a considerable advantage in dentistry. The chlorin solutions were not found satisfactory for use in gangrenous root-canals until the advent of the solution called dichloramine-T. (4) This preparation is a yellow-white crystalline powder soluble in organic matter and oils but unstable in solution. It is recommended for use in a solution of chlorinated eucalyptol and paraffin oil or petrolatum. It yields chlorin slowly from the oily solution, and when sealed in a tooth for several days, will continually yield chlorin, which is recognized as one of the best antiseptics and disinfectants today. The action of this solution, which is toluene-sulphon-dichloramine, is based upon its high chlorin content linked to nitrogen. It does not precipitate or coagulate albumen, but has a tendency to dry up the wound and produces a rapid and healthy granulation. This preparation has the highest recommendation by Dr. Herman Prinz for the treatment of gangrenous root-canals. It will be found to give satisfaction if used properly.

For several years chlorin liberated from a solution of sodium chloride by ionization has been recommended by Dr. M. L. Rhein and others. Dr. Prinz (3) states that "the process of electro-sterilization of infected root-canals as a means of establishing asepsis is an advanced step in dental therapeutics, and is deserving of earnest consideration by the clinical practitioner."

In cases where there are absorptions about the apex of the root, there is frequently found to be considerable discharge or draining of liquid into the canal from the area. The discharge can be controlled by forcing tincture of iodin thru the foramen. Equal parts of beechwood creosote and tincture of iodin may be sealed into the canal in very moist dressings. No fear need be felt that the iodin will discolor the tooth, for experience will soon convince one that it does not and the result will be very gratifying.

Bacteriology.

In all infected cases the operator should verify his clinical judgment of having obtained asepsis, by taking a culture from the canal. A canal saturated with any antiseptic will not give a fair test. It is necessary to wash the canal out thoroly with alcohol, followed by sterile water, absorb the water away, and then seal into the canal a dry bit of cotton or absorbent paper point very thoroly to prevent any contamination from the outside. This should remain from 24 to 48 hours and then be removed carefully; a smear should be examined under the microscope and a culture made, to see if the canal is free from bacteria. It must be remembered that it is impos-

sible completely to sterilize all the dentin, but the inner exposed area can be freed from bacteria after mechanical cleaning and treatment and then the canal should be thoroly filled with guttapercha.

Following Up.

The case should be recorded with all the data concerning each tooth in regard to condition presenting, treatment used, method of filling, and radiographs. At intervals the patient should be sent for and radiographs made to show the progress of the recovery as well as to insure the patient against any further development of trouble at the root end. If operators will adopt some uniform method of recording and following up, it will be of inestimable value to the progress of this line of work.

The problems involved in the treatment and filling of root-canals are both mechanical and bacteriological. Perfect mechanical filling, after careful treatment with antiseptics which will not injure the periapical tissue, will show very gratifying results and I feel confident that the future will reveal a very large percentage of success in all cases so handled. The natural tooth is not to be compared with an artificial substitute for comfort and usefulness when it can be saved without jeopardizing the patient's health; and by following these cases along by means of radiograph for a few years and recording the condition about the root end, we shall soon be able to state with more clinical proof that such treatment is successful.

Reference.

1. Journal of American Medical Association, October, 1918.
2. Special Dental Pathology.—Black.
3. Dental Materia Med. and Therapeutics.—Prinz.
4. American Journal of Clinical Medicine, September, 1918.

Discussion.

John E. Nyman: Whether or not to allow a pulp to remain, is often a perplexing question, but if the continued vitality of the pulp is dubious, it is wiser to devitalize and fill the canals under aseptic conditions.

Altho the radiographic examinations shown by the essayist are encouraging, it must be remembered that radiographic evidence is not final. I cannot help feeling that the conclusions drawn by the essayist are optimistic conjectures rather than certainties. Frequently, coincident with the destruction of the cancellous bone structure will proceed a sclerosis of the cortical region which gives sufficient radiopacity to conceal full evidence of an infected cavity behind. On the other hand, radiographs may seem to show but a partial root filling, where as opening up the canals shows them apparently filled to the apex. The explanation in some cases is that the foramen is located, not at the apex, but on the side of the root, as far as 2 mm. from the apex, and that this abnormal location, when on the labial, buccal or lingual side, is not betrayed in the radiograph.

Results obtained by the use of the faradic or galvanic current must be controlled by radiographic evidence, for occasionally we find, in teeth with multiple roots, that one root will be devitalized while the other is vital. I have found that viewing the film in front of a strong light, thru reversed opera glasses, brings out the infected areas more distinctly.

For pulp removal, I prefer regional and pressure anesthesia for immediate removal, and for gradual pulp extirpation the use of arsenic paste, in the manner advised by the essayist, followed by pressure anesthesia after counteracting any free arsenic trioxid that may be left. No useful drug should, I think, be condemned because careless or injudicious use makes it dangerous.

Diseased pulps give rise to our greatest problems. Whatever the evidence given by the radiograph, we may be sure that when opening the pulp chamber re-

sults in a discharge of foul gas and pus, the condition must be met with surgical procedure.

As therapeutic agents in addition to those mentioned by the essayist, I find use for arsenic, sulphuric acid, potassium, sodium, and other drugs of great chemical power.

In acute infection, I think we are more successful when we simply open the pulp chamber and leave it alone until later on when the swelling and soreness have disappeared and the operator can give the tooth the time it requires for antiseptic treatment.

As to aseptic measures, I sterilize my instruments and cotton points with dry heat, and never insert a broach in a root-canal without first dipping it in 70% alcohol. The gutta-percha points are sterilized by immersion in alcohol to which 5% iodin crystals have been added.

Opening the canal to the apex offers the greatest operative difficulty today. We cannot escape the fact that we often have to use drugs that will dissolve the contents of root-canals, because, owing to abnormal anatomy, we cannot penetrate the canals with any broach.

As to ionization, Dr. M. L. Ryan is of the opinion, I think, that his best therapeutic effects are secured by the formation of a chloride of zinc solution. Ionization frequently stops a discharge from the canals, and subsequent radiographs show a radiopacity that suggests that the cyst has disappeared and new bone has formed in its place. The explanation is probably that the bone cavity has been filled with a coagulum from the chloride o zinc, which is not easily broken down or infected by bacteria. If the canal is pumped full of chloropercha, followed by gutta-percha points, the bone cavity will always fill up with the chloropercha solution.

Root resection, I believe, lies in the realm of what we might call conservative surgery, whereas tooth extraction belongs to destructive surgery. The root of a lateral incisor, with a history of a number of years of infection, which I resected fourteen years ago, disclosed no infection in a radiograph a week ago and was firm in the mouth. There had been no recurrence of the discharge and there were no signs of the systemic effects of an enclosed infection.

As to the technic of root resection, the apical section of the root-canal is filled, but whether or not is filled quite to the apex I do not care. Then the root-canal is reamed out as far as possible with a No. 3 or No. 4 root-canal plugger. This section of the root-canal is filled with copper amalgam, for, as one cannot cut across a gutta-percha root filling without dragging the gutta-percha away from one side of the root-canal, it is necessary to have a copper amalgam root filling at the plane of resection. Root resection sometimes fails because of residual infection lodged in irregular tubuli and lacunae. Therefore, I paint the resected root surface with a strong solution of silver nitrate. The bone cavity is then washed out with an aqueous solution of iodin. A blood clot is allowed to form, and the incision flap is sewed together. Radiographs of these resected areas, it must be admitted, are not encouraging. There is always shown evidence of an apparent infection and rarefaction of the bone tissue, probably due to the fact that the secondary bone tissue does not organize so completely as the original tissue.

In regard to the extraction of teeth with infected apical areas, it is necessary to recognize that the operator may not cure the disease by mere extraction. Grave infections in the neck, in the sublingual region, in the submaxillary region, and in the antrum sometimes result. Part of the cyst may remain, and this part, closed over, may begin the formation of a monolocular or a multilocular cyst, and result, possibly, in a pathological fracture of the jaw and even the loss of a section of the jaw from pressure

necrosis. To prevent these infections, the socket of the extracted tooth must be thoroly curetted, swabbed out with iodin solution, and packed with iodiform gauze saturated in compound tincture of benzoin. The socket is usually packed three times at intervals of three days.

In curetting in the lower molar region, one should be very careful not to invade the inferior dental canal, which sometimes lies very near the apices of the lower first molar. Like care should be taken in curetting in the region of the upper first molar and the bicuspids not to invade the floor of the antrum. It is better to allow any leakage from the first molar into the antrum to drain naturally than to break into the floor of the antrum with the curette, for chronic fistula may result. If necessary later, one may operate from the region of the canine fossa, for chronic antrum infections invariably involve the anterior inferior angle with its mass of honeycomb cells. Until these are cleaned out, a chronic antrum case will never clear up.

A. D. Black: We do not know the causes of chronic alveolar abscess. We know it follows the death of the pulp, but we do not know how many should be charged to those changes which take place within the dead pulp tissue, and how many to other causes. Dr. Coolidge was kind enough to refer to some work that I have been doing in the study of these conditions. I reported the examination of radiographs of some 1500 root-canal fillings, which showed about 9 per cent. of failures in those cases in which the fillings appeared to have been well made, and about 63 per cent. of failures in cases in which the root fillings were poor. These were not my own root-canal fillings, but were examinations of radiographs which were taken under my supervision, the large percentage of them being full sets of mouth radiographs of members of the senior classes in Northwestern University Dental School during the past few years. They represented a very wide range of operators.

I wonder how many of us know how many pulp cases we treat in a year. I have a record of every one since I have been in practice and of every separate treatment. I had my assistant count up today the number of cases in which I had removed vital pulps or dead pulps from July 1, 1917, to July 1, 1918; the record showed the removal of 51 vital pulps and 9 dead pulps. I do not know whether these figures would be above or below the average, but I am quite certain that each of you would greatly overestimate the number of cases you treat, unless you have made actual count. I call attention to this because some men have hesitated to undertake more thoro root-canal operations on account of the greater time required. There are not so many but that we should be able to give them all the time that is necessary and I can think of no more valuable service.

I have felt for some time that we were not going to get the real facts which we need in the study of this pulp problem without having the cooperation of many practitioners in the collection of thousands of good case histories. I have had three lantern slides made that I want to show tonight to illustrate a simple means of keeping the record of pulp conditions, the diagnosis, the treatment and the subsequent inspection. I present them solely for this purpose and I hope by this presentation to gain the interest and cooperation of a good many members of this society and of other societies, so that within a few years, we may have tabulated enough case histories to serve us as a basis of more rational consideration of this condition. The particular plan that I am presenting is one that Dr. Coolidge and I have worked out together.

(Dr. Black showed lantern slides of a case history sheet on which a complete record of diagnosis, treatment, and subsequent radiographic examinations could

be made by simply entering an X or the date, each time the patient presented.)

Dr. Coolidge spoke of blood counts in connection with the radiographic studies. We are making blood counts in all cases where we take full mouth radiographs, and we are getting some very interesting information. A large number of cases have presented either peridental or apical infections with a white cell count of ten, eleven, or twelve thousand. Of course we are following up as many as possible of these cases with subsequent blood counts. It will require a large number of these before we are justified in drawing conclusions.

In connection with testing with the faradic current, it has been my custom to take a piece of rubber dam and slip it over each tooth separately as I test it. By this plan the transmission thru fillings to proximating teeth is avoided.

These radiographic illustrations of the changes which take place in the bone following root-canal filling or root amputation are very interesting. However, I cannot help feeling that a good many of us are getting away from the basic things as we examine these radiographs. It is of very little account that we have radiographs showing large abscess cavities within the bone and subsequent radiographs showing that these cavities have filled in with bone afterwards. We should naturally expect the bone to build in when the source of the infection is eliminated, but that does not necessarily mean that the menace to the individual is removed, or that there has been complete healing.

Dr. Coolidge called attention to the building in of the bone about the roots of the teeth and the showing in subsequent radiographs. His observation agrees with my own as reported to this society a year or two ago; namely, that in cases in which the bone did build in about the end of a previously denuded root and we thought we had a very happy result, the radiograph taken six months later often showed a cavity in the bone, meaning that the bone had been again destroyed. What does that mean? It means that we had eliminated the original source of infection and that the bone which filled in the cavity did not attach to the root of the tooth, but that there was serum between these two which became infected and that the bone was destroyed again. That is a thing to be expected. We must come back to the basic fact stated by Dr. Coolidge tonight, that when the cementum is denuded by suppuration, there will be no re-attachment, and the condition is not safe. For the same reason I think ionization is a failure in these cases. Neither would I recommend forcing gutta-percha thru the end of the root. That only obscures the situation. The preceding speaker stated that he left these teeth in if they gave the patient no discomfort in mastication. I hope we have gotten past that in the practice of dentistry. If we recognize the relation of these foci of infection as a real menace to the health, we must eliminate every such focus. We cannot permit such teeth to remain in the mouth even tho they are comfortable and serviceable for mastication.

A. H. Mueller: Dr. Weston A. Price, in his last report of the National Research Institute, said that we have two drugs which will absolutely sterilize diseased and infected root-canals; namely, iodin and silver. Silver salts give an ugly discoloration to the tooth even thru the gum tissue; but, generally, as Dr. Coolidge has said, iodin does not do this, and even if it does, it can be bleached with sodium hyposulphite, after it has sterilized the canal.

Another thing that Dr. Price gave us is the use of resin and chloroform as root-canal filling material. He showed that resin dissolved in chloroform will penetrate all crevices of the root-canal, and in that way seal up all the foramina. He advised the use of these in conjunction with gutta-percha and chloroform.

I am able better to fill all root-canals by this technic. I believe that iodin will go to the extremities of the root-canal just as a drop upon the finger will go thru all the crevices of the skin.

The difficulty, which sometimes occurs, of getting iodin to go to the end of the root-canal of an upper tooth, can be overcome by wrapping a little cotton firmly around a broach and pumping the iodin up into the canal.

In the case of a tooth that has the pulp partially destroyed or partially dead, owing to infection, it is no longer necessary to use arsenic to destroy the rest of the pulp that happens to be humane, nor is it necessary to use 95% phenol, which is painful. Block off that tooth with a local anesthetic, apply a rubber dam, and flood the pulp chamber and canals with iodin. That will sterilize the canal in a few minutes; and the tooth, being anesthetized, one can then remove the fragments of pulp at the apex. This method has been successful in my hands. I like it better than arsenic, and better than phenol.

Knowing that we have two drugs that will absolutely sterilize root-canals, why not use them, and in this way overcome the doubt of a sterile canal and the necessity of taking a culture from the canal to determine the sterility of a tooth.

T. W. Brophy: In the study of this subject, we must not forget to take into consideration the general condition of the patient. If the patient has some specific disease which saps his vitality, such as tuberculosis, the operator will have little success in effecting the cure of an abscess formed about a tooth.

We must also consider the problem of sterilization. In the first paper I ever read before the Illinois State Dental Society—a paper on the treatment of exposed pulps—I took a position contrary to the opinion of a great many members of that society, and stood practically alone in declaring that chlorid of zinc in an exposed pulp would kill that pulp. Oxychloride of zinc was first suggested by Dr. William H. Atkinson in the seventies; he said all that was necessary was to excavate the cavity, place in it some oxychlorid of zinc, and when it hardened, fill the tooth. I have filled root-canals with oxychlorid of zinc, and have found that it sterilized them completely and that, following its use, abscesses occur but rarely.

Radiographs cannot be relied upon as the sole evidence for making a diagnosis. Skiagraphers who make diagnoses from their pictures and send written reports to the dentists, show bad judgment; they know nothing about the actual condition of the teeth. A careful examination is necessary in order to ascertain whether pathological microorganisms are actually present.

Dr. Coolidge (closing): There have been some very interesting things brought out in the discussion. I want to call attention especially to the charts mentioned by Dr. Black. I feel that they are just what we need to lead us to some definite conclusion. I agree with Dr. Black that we are just guessing at many of our conclusions. Each of us must be willing to do something along this line if we want to get anywhere in root-canal work. If we can have one hundred men in Chicago make records of this kind, in five years' time we shall have records to prove or disprove things we are guessing at now. For instance, we discover in the radiograph rarified areas in the apical region about the roots of teeth and begin treatment of those teeth, assuming that these areas are always infected. That is the only safe assumption. We cannot consider the cause of the rarified area but must treat it as an infected area. It may be arsenic or phenol or some other drug that caused the absorption. It may be a mechanical injury. It may be a pressure absorption. We cannot determine the cause of these absorptions until we get some records. I think

those records will show us many things that will aid us.

Dr. Dittmar: Why is it that sometimes we see those areas over the ends of teeth that presumably have healthy pulps?

Dr. Coolidge: The radiograph does not lie. It is simply the picture of an object as a shadowgraph. Where there is a dark area in the negative, there must be a hollow place in the object; otherwise there would be a uniform density in the negative. We cannot always tell what makes that hollow place. It is not always a pathologic condition. I reason that there is often an absorption of bone from some unknown cause or from some mechanical injury—such as the movement of a tooth under abnormal occlusal force—that leaves a larger hollow in one place in the alveolar process than in another. The alveolar process is not always uniformly dense. Such hollow spaces or areas may be found at the apex of a root or sometimes in the process away from the end of the tooth. But if it should occur at the end of a tooth that had a poor root-canal filling, we would look upon it as a pathologic condition. That is why I do not like to say that we must always resect such a root or extract the tooth.

Dr. Nyman said that my interpretation of my lantern slides was most optimistic and then went on to tell of his beautiful results from resecting the root, which do not show in the radiograph.

Dr. Nyman: I said I was perfectly willing to admit that there might be reorganization, but you showed radiographs so different that I did not feel you had eliminated the infection.

Dr. Coolidge: Getting uniform radiographs is a mighty hard thing to do. I can go over a whole mouth and get almost uniform radiographs. If that patient returns after a period of months I cannot get exactly the same radiographs either in position or density. There are many things that enter into a radiograph that are difficult to control. If the machine is not working the same, there will be a little variance. When the radiograph is developed, there is a chance for a difference. When we have lantern slides made, there is another chance for a difference. Some of these lantern slides were made previous to this meeting. These lantern slides were all made by the same firm, but they are not uniform.

In regard to chloropercha not being opaque to the X-ray, I wish to say that such a statement is not entirely correct. I do not question at all that you can file down some roots filled fairly well and show chloropercha or gutta-percha in the root-canal farther than it shows in the radiograph, but you cannot depend on that. You have no evidence of a filling that does not show in the radiograph. We are going to do harm by assuming that the canal is filled if it does not show it is filled in the radiograph, because there are a great many men who are going to say, "The canal is not filled in the radiograph, but the chloropercha does not show, and so it is all right." A great many mistakes are going to be made on the basis of that statement I am afraid. If you extract and file down filled roots, you will find some are filled better than they show in the radiograph, but you do not know beforehand which cases; but when you can see it in the radiograph, you know the filling is there, and the more dense you pack it into that tooth, the more definite a shadow will appear in your radiograph. The thing we are all looking for is good root-canal work, and we cannot accept a root-canal filling as a good filling that does not show gutta-percha to the end of the root-canal. We cannot accept a root-canal filling as a fair filling unless the radiograph shows gutta-percha as far as the open space in that canal. Let us be careful that we do not advocate something that will help some

fellow to stop before he gets his canal filled as well as he can fill it. That same fellow may be one of us. It is just as hard for me to take a root-canal filling out and do it over again as for any one else.

I do not like to give a wrong impression on this problem of filling root-canals. I do not like to show lantern slides that may be questioned. I agree with the criticisms. They were all right. I expected them. From these radiographs, taken at various intervals of time after filling the roots of teeth and showing areas about their apices, I am trying to get some information by which to classify, as far as possible, the conditions that can be cured by treatment and the conditions that cannot be cured without extraction or resection, and trying to determine some line of distinction between these two classes of cases. It is difficult to do that. I do not know how we can do that until we have followed a long line of cases in similar conditions that appear very much alike in the radiographs over a period of years. The proportion of those that are successful to those that are failures may show that some of these teeth can be permanently cured by treatment only. That will depend on the amount of cementum denuded and infected, a thing which is very difficult to tell in the radiograph. If that is true, the only way to proceed is to treat some of these teeth and watch them; and if the areas persist, to cut off the roots.

Just another word in regard to over-filling the root-canal. I do not like to do it. That has happened in many cases but I try to avoid over-filling. If I could just fill it full and stop there I would always do it. I try to do that by measurements. Some times a little of the gutta-percha goes thru. In my effort to fill the collateral branches I often get a little chloropercha thru. I try not to over-fill the root-canal, especially one with healthy apical tissue.

The Research Department

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THE EFFICIENCY OF CURRENT METHODS USED IN THE STERILIZATION OF DENTAL INSTRUMENTS AND OF ROOT FILLING MATERIALS.

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(Read before the National Dental Association at Its Twenty-Second Annual Session, Chicago, Ill., August 5-9, 1918.)

THE following is a preliminary report of the experimental laboratory work conducted at the Research Institute in Cleveland during the past four months with reference to a branch of the main problem indicated by the title, i. e., the relative efficiency of typical devices used in the sterilization of root-canal instruments. The sterility or sterilization of root filling materials has not been considered except with reference to absorbent and gutta-percha points.

For a statement of the extent to which different kinds of devices are used in dental offices one is referred to the report of Ada R. Holmes (vi.) In addition to this, in the report of H. E. Hasseltine (v) the general methods of sterilization are reported on. It has been considered essential to carry these investigations one step further and compare the different sterilizers as regards their relative efficiency against mixed cultures of oral and a pure culture of a known resistant strain of organisms.

The Institute has had the assistance of Messrs. Samuel Coopersmith, John E. Millen and Miss E. C. Weston, assistants in the bacteriological laboratory, and of the Local Dental Advisory Committee. Manufacturers, dealers and practicing dentists have also cooperated in the work.

To date the work has been mainly upon the literature of the subject, previous studies and reports which throw light upon the questions at hand and the development and application of a plan of experimental work which is possible of being subjected to clinical and routine office tests. The aim is essentially a

practical one, to provide a safe guide in the sterilization and the use of instruments and materials involved in root-canal operations. Results of investigations such as this may be qualified by later work and by a closer relation to the needs arising from office practice.

The determination of the relative efficiency of sterilizers was undertaken at the suggestion of the Local Dental Advisory Committee of the Institute and also to aid in solving a local difficulty in connection with certain laboratory operations. A knowledge of the relative efficiency of sterilizers will augment such studies as those of Hasseltine (v), Holmes (vi) and Callahan (iii, iv) with regard to the sterilization of dental instruments, and will, it is hoped, further aid in limiting the spread of infection thru operations.

Investigations of this character are distinctly technical and largely a matter of routine, and along the lines already established by investigators in the fields of sanitation and bacteriology. Certain modifications have been made of course to suit the local conditions and the need at hand. There is no claim to originality in method or utensils.

General Considerations.

Generally speaking, sterilization is the destruction of the micro-organisms, whether accomplished by physical or chemical means. Of the physical agencies, heat is the one most usually brought into play and commonly in connection with air, water, or even chemicals. Various reagents have been recommended for chemical disinfection, among them, those most used, are formaldehyde, paraldehyde, cresol and phenol or their derivatives, and the alcohols. The most common devices for the sterilization of small instruments and of the materials used in root-canal work, utilize boiling water, streaming steam, steam under pressure, superheated steam, hot air and formaldehyde gas from formalin. Recently molten metal has been adapted in the form known to the trade at the Flaherty Molten Metal Sterilizer. Our work has been for the present confined to this group, that is, (1) the combination of steam and hot air recommended by the late Dr. Callahan, and others, (2) superheated steam, the so-called "Pentz System," (3) the molten metal, both of the Flaherty model and a laboratory automatically regulated electrically heated device, (4) and a glass cylinder model of formaldehyde gas sterilizer typifying the glass cabinets on this principle. In the laboratory, used on other work and serving for purposes of comparison there are steam under pressure, (the autoclave), the hot air oven, (Lautenschlager) and boiling water with and without admixtures.

Work with the molten metal and the steam-hot air sterilizers is far enough along to warrant a statement of the results. The sterilizer utilizing superheated steam, which we were using has presented certain peculiar complications and has finally broken while in use, making it impossible to report definite results at this time. In connection with the formaldehyde sterilizer we were led temporarily to discontinue the work until more incubator room could be provided, altho some preliminary experiments are sufficiently far enough along to indicate the direction of results.

Technic.

The usual method of testing the growth of organisms by comparing the results of similar inoculations in different media has been followed. The most suitable form of artificial bacteriological culture medium was found after a series of tests, to be a modification of the ascites-beef-peptone-dextrose broth after Henrici and an ascites agar after Rosenow. Controls were run for some time against beef bouillon until it was clearly indicated that the organisms with which we were dealing were cultured best on the

ascites-dextrose medium. Tests of turbidity readings (frequently taken to represent bacterial growth) indicated that where metal remained in the media for any length of time there was a chance for error. Check tests by transplanting and plating have consequently been made in such cases. Most of the preliminary and all of the later tests have been run with B. pyocyaneus as an indicator, to check up technic and ascertain the limits of certain variables. These have been repeated with hay bacillus to determine the conditions under which a known resistant micro-organism may be killed, and then followed by tests with a suspension of mixed oral flora in broth, made by crushing a freshly infected tooth in a mortar and shaking the particles in about five hundred cubic centimeters of ascites-dextrose broth. The mixed oral culture was used within twenty-four hours after preparation.

Tubes of sterile broth or agar without inoculation are always kept along with others as controls, until the tests are completed. Our experience has been that it requires about five weeks before experiments can be considered complete wherever formaldehyde is used. It has been found that exposure to the gas brings about inhibition of the growth of organisms, as long sometimes as two to three weeks. Two weeks additional is then allowed before observations are suspended.

With the sterilizers our observations have included the limits of the apparatus and an attempt to estimate the optimum working conditions. Physical and chemical characteristics of the devices have hence been reported. Differences also in amount and kind of materials to be sterilized have been considered, as well as certain manipulations incident to the use of some dental instruments. No attempt has been made to go outside of the equipment and materials used in the dental office.

EXPERIMENTAL RESULTS.

I. Molten Metal.

A series of tests have been made with one model of a molten metal sterilizer, known as the Flaherty. Previous tests by the Hygienic Laboratory of the Wisconsin Board of Health made by Dr. Harris were considered to be incomplete and inconclusive as the conditions under which he worked were not carefully reported. In our series we have attempted to ascertain (1) the melting point and its changes as affected by constant heating; (2) the minimum time required to sterilize smooth, twisted and barbed broaches of different sizes, viz., fine, medium and coarse; (3) the minimum time required to sterilize the same broaches, except the barbed, with cotton wrappings suitable for large and small canals; (4) the effect of hand wrapping upon the cotton with care and without care as to the condition of the hands and fingers; (5) the minimum time to sterilize absorbent points which were found to be contaminated.

The melting point of the metal as received and before use in the laboratory was approximately 150°C,* but this point was observed to raise from day to day and was between 158° and 160°C after two months' use. The temperature had seldom been kept at the melting point altho attempts had been made to control radiation and convexion by different flames and hoods. Alcohol and gas flames, even small ones, are extremely variable in laboratory and probably likewise in office use. The changing melting point suggests a changing composition.

The following results (Table I-A) indicate that smooth and twisted broaches cannot be sterilized unless they are held in the molten metal for five seconds or over. Merely dipping in the metal, holding for one and three seconds does not suffice against a pure culture

*The temperature readings are uncorrected.

of staphylococcus. Cotton wrapped twisted broaches were practically in the same class. The temperature at which sterilization was accomplished was between 190° and 210°C. At the temperature suggested by the manufacturers 175°-190°C a slightly longer time is required. This temperature, however, can only be maintained with precautions against radiation and convexion. Absorbent points, found contaminated in their original packages were sterilized if exposed for ten seconds at the higher temperature (190°-210°C). The points were not scorched nor did they appear to be injured, insofar as laboratory observations are a guide.

A difference in the time required for sterilization appears if care is used in the cleansing of the hands before wrapping. (Tables I-B, A-1 and A-2.) In the series the operator's hands were washed thoroly with soap and hot water, scrubbed, and then rinsed in 50% ethyl alcohol. The fingers were dipped in the alcohol before wrapping the cotton each time in the reported experiments. Cotton wrapped broaches with these precautions were sterilized in the molten metal in ten seconds, whereas it required fifteen seconds to sterilize those when such precautions were not taken, tho no extra pains were taken to contaminate the wrappings.

These laboratory tests bring out certain advantages and disadvantages which may be mentioned here. The sterilizer is relatively shallow and small in diameter. It appears to be sufficient to sterilize the length of a broach more

TABLE 1-A.

Molten Metal Sterilizer.

Material	No. used	+	−	No. days	Controls	Culture	No. and condition on exposing.	Time	Temperature
A—Broaches, smooth	5	1	4	7	4	Staph.	Moist, one at time	½ sec.	290°-307°C
Twisted, Assorted	7	2	5	7	6	Staph.	Moist, one at time	½ sec.	290°-307°C
Wrapt, assorted	6	3	3		6	Staph.	Moist, one at time	½ sec.	280°-290°C
Assorted	50	2	48	2		Staph.	Moist, one at time	5 sec.	200°-220°C
Assorted	93	11	82	2		Staph.	Moist, one at time	1 sec.	190°-210°C
Absorbent points	110	97	13	2		Staph.	Dry, one at time	1 sec.	190°-210°C
Absorbent points	42	18	24	2		Staph.	Dry, one at time	5 sec.	190°-210°C
Absorbent points	70	1	69	2		Staph.	Dry, one at time	10 sec.	190°-210°C
Broaches, wrapt	40	7	33	2		Staph.	Moist, one at time	1 sec.	175°C
B—Burs, assorted 1	5	1	4	7	—	Mixed oral.	Moist, one at time	5 sec.	180°-190°C
2	5	0	5	7	—	24-hr. broth	Moist, one at time	10 sec.	180°-190°C
3	5	0	5	7	—	media	Moist, one at time	15 sec.	180°-190°C
4	5	0	5	7	—	"	Moist, one at time	20 sec.	180°-190°C
6	5	0	5	7	—	"	Moist, one at time	25 sec.	180°-190°C
7	5	0	5	7	—	"	Moist, one at time	30 sec.	180°-190°C
C—Burs, assorted 1-a	6	0	6	7	—	Mixed oral.	Dry, one at time	5 sec.	180°-190°C
1-b	6	6	0	7	—	24-hr. broth	Moist, one at time	5 sec.	180°-190°C
2-a	6	0	6	7	—	culture	Dry, one at time	10 sec.	180°-190°C
2-b	6	2	4	7	—	"	Moist, one at time	10 sec.	180°-190°C
3-a	6	1	5	7	—	"	Dry, one at time	15 sec.	180°-190°C
3-b	6	3	3	7	—	"	Moist, one at time	15 sec.	180°-190°C
4-a	6	0	6	7	—	"	Moist, one at time	20 sec.	180°-190°C
D—Absorbent points 3-a	8	6	2	7	—	Pyocyaneus	Dry, one at time	2.5-3 sec.	180°-190°C
3-b	8	8	0	7	—	"	Moist, one at time	2.5-3 sec.	180°-190°C
1-a	8	7	1	7	—	"	Dry, one at time	5 sec.	180°-190°C
1-b	8	8	0	7	—	"	Moist, one at time	5 sec.	180°-190°C
2-a	8	2	6	7	—	"	Dry, one at time	10 sec.	180°-190°C
2-b	8	8	0	7	—	"	Moist, one at time	10 sec.	180°-190°C

than equal to the length of the longest tooth. The efficiency of the sterilizer diminishes, however, near the surface of the metal and broaches and separating saws held just at the surface are not satisfactorily sterilized. It must be understood that this is a decided handicap for contamination may come from the portion of the broach or bur not exposed to the molten metal. Generally speaking, the temperature is low enough to permit the use of sharp tempered instruments and cotton. The tendency, in two printed articles. (iii, iv) The report of Holmes (vi) indicates that the Halverson and Wilmot Castle types are in considerable use. The principles are of course those utilized by most bacteriological laboratories. The small size of device and with the combination is somewhat more convenient. We have in these experiments used the Rochester model, Castle No. 110.

Following Callahan's suggestion we have utilized the hot air to dry off instruments and materials. Hence, we depend

TABLE 1-B.

Molten Metal Sterilizer.

Material	No. used	No. +	No. −	No. days	Controls	Culture	No. and condition on exposing	Time	Temperature
A-1, Kerr twisted broaches wrapt, no care in wrapping 1	12	5	7	2	+	None. Air and room contamination.	Dry, one at time	5 sec.	180°-190°C
2	12	3	9	2	+		Dry, one at time	10 sec.	180°-190°C
3	12	0	12	2	+		Dry, one at time	15 sec.	180°-190°C
4	12	0	12	2	+	"	Dry, one at time	20 sec.	180°-190°C
A-2, same as A-1, care in wrapping 5	12	4	8	2	+	"	Dry, one at time	2.5-3 sec.	180°-190°C
6	12	5	7	2	+	"	Dry, one at time	1 sec.	180°-190°C
7	12	1	11	2	+	"	Dry, one at time	5 sec.	180°-190°C
8	12	0	12	2	+	"	Dry, one at time	10 sec.	180°-190°C
9	12	9	12	2	+	"	Dry, one at time	15 sec.	180°-190°C

with available flames, is for the temperature to be raised and oxidation of the most oxidizable ingredient of the alloy is the result. A slag or metal scum invariably forms on the surface and is not easily removed by tapping or rubbing. Anything which requires such tapping and rubbing is not good bacteriological technic, and permits of possible extra contamination. The device is small, easily operated, and handy. These appealing features should not, however, be allowed to weigh too strongly against the more important.

II. Steam and Hot Air.

A sterilizer using this combination of streaming steam and hot air was strongly recommended by the late Dr. Callahan upon the steam to sterilize. The practice has been to heat the chamber above the boiling water, without materials in the trays and without allowing the streaming steam to enter the chamber. This step was simply an arbitrary laboratory precaution so that the time at a certain temperature might be recorded. In actual practice this may be done away with. Materials are put in trays and the steam is then permitted to enter the chamber. With a natural gas flame turned up so that it just creeps over the bottom edge the temperature in the upper chamber, at the time of admitting the steam may be anywhere from one hundred and fifteen to one hundred and fifty degrees centigrade, depending,

of course, upon radiation and rate of air movement about the sterilizer. As our tests were not aimed at drying the materials we have for the present been mainly concerned with the minimum time which steam, under the conditions mentioned, will sterilize the various instruments and materials. Preliminary observations with regard to the drying, however, indicate that it takes from five to twenty minutes, depending upon the condition of the steam chamber, of the materials, and the amount of materials, to dry the materials thoroly after the steam has been shut off. Allowing for this final heating with hot air the time of exposure to the streaming steam could be shortened somewhat to accomplish sterilization. Later tests may indicate how much this is true.

Twenty experiments (Table II) with burs, wrapt and unwrapt broaches, absorbent points and gutta-percha points indicate that from fifteen minutes to thirty minutes exposure to steam is necessary to accomplish sterilization. Gutta-

TABLE II.

Instruments and Material	Tubes used	Plus growth	No growth	Length of time incubated	Culture	Condition on Exposing	Method of Exposure	Time of Exposure	Experiments
Burs	16	0	16	8 days	Hay B.	Moist	Steam	30 min.	I
Absorbent Points	16	0	16	"	"	"	"	"	I
Wrapt Broaches	16	0	16	"	"	"	"	"	I
Burs	16	0	16	"	"	"	Steam	15 min.	II
Absorbent Points	16	0	16	"	"	"	Hot Air	20 min.	II
Wrapt Broaches	16	0	16	"	"	"			II
Burs	16	0	16	"	"	"	Steam	10 min.	III
Absorbent Points	16	0	16	"	"	"	Hot Air	20 min.	III
Wrapt Broaches	16	0	16	"	"	"			III
Burs	10	0	10	9 days	"	"	Hot Air	20 min.	IV
Absorbent Points	10	0	10	"	"	"	"	"	IV
Wrapt Broaches	10	7	3	"	"	"	"	"	IV
Unwrapt Broaches	10	2	8	"	"	"	"	"	IV
Burs	10	1	9	"	"	"	Steam	10 min.	V
Absorbent Points	10	0	10	"	"	"	"	15 min.	V
Wrapt Broaches	10	3	7	"	"	"	"	"	V
Unwrapt Broaches	10	0	10	"	"	"	"	"	V
Burs	10	3	7	"	"	"	Hot Air	10 min.	VII
Absorbent Points	10	1	9	"	"	"	"	"	VII
Wrapt Broaches	10	6	4	"	"	"	"	"	VII
Unwrapt Broaches	10	0	10	"	"	"	"	"	VII
Burs	10	0	10	"	B. Pyo-cyaneus	"	Steam	10 min.	VIII
Absorbent Points	10	1	9	"	"	"	"	"	VIII
Wrapt Broaches	10	2	8	"	"	"	"	"	VIII
Unwrapt Broaches	10	0	10	"	"	"	"	"	VIII
Burs	19	10	9	14 days	Hay B.	"	Steam	15 min.	IX
Absorbent Points	20	8	12	"	"	"	"	"	IX
Wrapt Broaches	19	19	0	"	"	"	"	"	IX
Gutta-Percha Points	20	1	19	"	"	"	"	"	IX
Burs	14	4	10	13 days	"	Dry	Steam	15 min.	X
Absorbent Points	14	11	3	"	"	"	"	"	X
Wrapt Broaches	14	5	9	"	"	"	"	"	X
Gutta-Percha Points	14	0	14	"	"	"	"	"	X
Burs	15	14	1	13 days	"	Moist	Steam	10 min.	XI
Absorbent Points	15	15	0	"	"	"	"	"	XI
Wrapt Broaches	15	13	2	"	"	"	"	"	XI
Gutta-Percha Points	15	13	2	"	"	"	"	"	XI

TABLE II (Continued).

Instruments and Material	Tubes used	Plus growth	No growth	Length of time incubated	Culture	Condition on Exposing	Method of Exposure	Time of Exposure	Experiments
Burs	20	20	0	2 days	Hay B.	Moist	Hot Air	10 min.	XII
Absorbent Points	20	20	0	"	"	"	"	15 min.	XII
Wrapt Broaches	20	20	0	"	"	"	"	"	XII
Gutta-Percha Points	20	20	0	"	"	"	"	"	XII
Burs	10	10	0	4 days	"	"	Hot Air	30 min.	XIII
Absorbent Points	10	10	0	"	"	"	"	"	XIII
Wrapt Broaches	10	10	0	"	"	"	"	"	XIII
Gutta-Percha Points	10	10	0	12 days	"	"	"	"	XIII
Absorbent Points	20	1	19	12 days	"	"	Steam	20 min.	XIV
Wrapt Broaches	20	2	18	"	"	"	"	20 min.	XIV
Absorbent Points	20	0	20	15 days	"	Dry	Steam	20 min.	XV
Wrapt Broaches	20	3	17	"	"	"	"	20 min.	XV
Burs	40	8	32	13 days	Infected Tooth	Moist	Steam	20 min.	XVI
Absorbent Points	40	0	40	"	"	"	"	"	XVI
Wrapt Broaches	40	0	40	15 days	"	"	"	"	XVI
Gutta-Percha Points	40	0	40	13 days	24 hours	"	"	"	XVI
Unwrapt Broaches	40	1	39	15 days	" "	"	Steam	20 min.	XVII
" "	32	0	32	5 days	" "	"	"	"	XVII
Wrapt Broaches	32	0	32	"	" "	"	"	"	XVII
Absorbent Points	32	0	32	"	" "	"	"	"	XVII
Burs	40	3	37	15 days	" "	"	Steam	25 min.	XVIII
Burs	32	0	32	5 days	" "	"	"	25 min.	XVIII
Absorbent Points	22	0	22	14 days	" "	"	Steam	15 min.	XIX
Wrapt Broaches	32	0	32	5 days	" "	"	"	"	XIX
Unwrapt Broaches	22	0	22	14 days	" "	"	"	"	XIX
Gutta-Percha Points	22	0	22	"	" "	"	"	"	XIX
Absorbent Points	32	1	31	12 days	" "	"	Steam	10 min.	XX
Wrapt Broaches	32	1	31	"	" "	"	"	"	XX
Unwrapt Broaches	32	1	31	"	" "	"	"	"	XX
Gutta-Percha Points	32	1	31	"	" "	"	"	"	XX

percha points take the least time of all, while burs appear to take the most. Metal tends to rust if placed on the racks. Rusting can be avoided, however, if the metal instruments are placed in small test tubes, which are plugged with cotton and exposed for a considerably longer time to the heat. Dr. Harris R. C. Wilson has adopted this method for metal instruments as well as materials and suggests it as practicable. Laboratory tests have not been completed after this plan but the idea is so practical and so in keeping with surgical technic that it seems worth while to mention it at this time.

III. Superheated Steam.

While laboratory tests were suspended because of a broken instrument, the following results will indicate the differences between it and the others and permit some comparisons. The use of this device has required a determination of certain factors upon which depend the efficiency of the apparatus, making the operation somewhat more complicated than any of the other devices. In every case in our tests the sterilizer has been cool to start, heated for 20 minutes on "high" heat, so-called, charged with water during this time once about every five seconds, then heated by the "low" coils and the tray of instruments or

materials to be sterilized is inserted at the same time adding a little more water. Some variation results with the number of instruments in the tray, tending to lengthen the time required for sterilization the more instruments there are inserted, indicating of course that a relative heat intensity is required. Instruments in the front of the tray invariably require a longer time for complete sterilization than those placed in the back, indicating a considerable heat loss at the open end. The optimum amount of water required for sterilization is derived from a well above the sterilizer body, and properly distributed thru a device so adjusted that the water is run into the chamber by the pressure and release of a small piston. (The amount of water delivered by this device is called a charge.) It appears from the tests of the Lederle Laboratories, those of the manufacturers and our own that charges must be more frequent than one per minute and less than six per minute, to obtain the best results. Infrequent charges of water lead to dry heat, and consequently, in the case of cotton, charring. Too frequent charging of water conversely leads to steam saturated with hot water vapor and requiring a longer time for sterilization. Wet materials and instruments for the same reason require a longer time to sterilize, for the water must be converted into steam and driven off before the microorganisms are destroyed.

The following results (Table III) were obtained up to the time the work was stopped and will be verified by extensions of the tests later. Ten experiments utilizing broaches, both unmounted and mounted, cotton wrapt broaches, assorted burs, and absorbent

TABLE III.

In every case when the sterilizer was cool to start with, it was heated twenty minutes on "high"; and the sterilization was continued on "low." Three or four charges of water were given while the instrument was heating on "high."

Experiments A thru G were allowed to incubate twenty-four hours.

Experiments H thru J were allowed to incubate seven days.

Experiment K was allowed to incubate seven to nine days.

Experiment	Instruments and Material	No. used	+ No.	− No.	Culture	Condition on Exposure	Time of Exposure	Charges
A (1)	Handle broaches plain, twisted and barbed	9	6	3	Mouth, 24-hr. culture	3 at time, moist	25 sec.	Charged on entering & once after 10 sec.
(2)	"	9	6	3	"	"	20 sec	"
(3)	"	9	9	0	"	"	15 sec.	"
(4)	"	9	7	2	"	"	10 sec.	Charged on entering & once after 5 sec.
(5)	"	9	8	1	"	"	5 sec.	Charged on entering
B (1)	Handle broaches plain, twisted and barbed	9	4	5	Mouth	3 at time, Moist,	25 sec.	Charged on entering & 4 charges after 5 sec. each
(2)	"	9	7	2	"	"	20 sec.	Charged on entering & 3 charges after 5 sec. each.
(3)	"	9	8	1	"	"	15 sec.	Charged on entering & 2 charges after 5 sec. each.
(4)	"	9	7	2	"	"	10 sec.	Charged on entering & 1 charge after 5 sec. each
(5)	"	9	9	0	"	"	5 sec.	Charged on entering & 1 charge after 2.5 sec.

TABLE III (Continued.)

Experiment	Instruments and Material	No. used	+ No.	− No.	Culture	Condition on Exposure	Time of Exposure	Charges
C (1)	Absorbent pts.	3	2	1	Mouth	3 at time,	25 sec.	Charged on entering & 4 charges after 5 sec.
(2)	"	3	2	1	"	"	20 sec.	Charged on entering & 3 charges after 5 sec.
(3)	"	3	3	0	"	"	15 sec.	Charged on entering & 2 charges after 5 sec.
(4)	"	3	3	0	"	"	10 sec.	Charged on entering & 1 charge after 5 sec.
(5)	"	3	3	0	"	"	5 sec.	Charged on entering & 1 charge after 2.5 sec.
D (1)	"	3	1	2	"	"	40 sec.	Charged on entering
(2)	"	3	0	3	"	"	30 sec.	" " "
(3)	"	3	3	0	"	"	20 sec.	" " "
(4)	"	3	3	0	"	"	10 sec.	" " "
(5)	"	3	0	3	"	"	50 sec.	" " "
E (1)	Handle broaches plain, twisted and barbed	6	0	6	"	Moist, 3 at time	50 sec.	" " "
(2)	"	6	4	2	"	"	40 sec.	" " "
(3)	"	6	4	2	"	"	30 sec.	" " "
(4)	"	6	4	2	"	"	20 sec.	" " "
(5)	Without handles	6	6	0	"	"	10 sec.	" " "
G (1)a	Handle Broaches wrapt plain twisted and barbed	8	5	3	"	Moist, 1 at time	30 sec.	" " "
b	"	18	14	4	"	Moist, 3 at time	30 sec.	" " "
c	"	30	23	7	"	Moist, 10 at time	30 sec.	" " "
(2)a	"	8	5	3	"	Moist, 1 at time	40 sec.	" " "
b	"	18	12	6	"	Moist, 3 at time	40 sec.	" " "
c	"	30	17	13	"	Moist, 10 at time	40 sec.	" " "
H (1)a	"	6	5	1	"	Moist, 1 at time	2 min.	Charged on entering and after 1 min.
b	"	12	9	3	"	Moist, 3 at time	2 min.	Charged on entering and after 1 min.
c	"	30	27	3	"	Moist, 10 at time	2 min.	Charged on entering and after 1 min.
(2)a	"	6	0	6	"	Moist, 1 at time	3 min.	Charged on entering and after each min.
b	"	9	4	5	"	Moist, 3 at time	3 min.	Charged on entering and after each min.
c	"	30	6	24	"	Moist, 10 at time	3 min.	Charged on entering and after each min.
I a	Wrapt broaches not dipt into infected media	6	0	6	Air and room contamination	Dry, 1 at time	2 min.	Charged on entering and after 1 min.
b	"	9	1	8	"	Dry, 3 at time	2 min.	Charged on entering and after 1 min.
c	"	20	4	16	"	Dry, 10 at time	2 min.	Charged on entering and after 1 min.
J (1)a	Burs, assorted	5	0	5	Mouth culture	Dry, 1 at time	4 min.	Charged on entering and after each min.
b	"	5	0	5	"	Moist, 1 at time	4 min.	Charged on entering and after each min.
(2)a	"	5	0	5	"	Dry, 1 at time	3 min.	Charged on entering and after each min.

TABLE III (Continued.)

	Experiment	Instruments and Material	No. used	+ No.	− No.	Culture	Condition on Exposure	Time of Exposure	Charges
	b	Burs, assorted	5	1	4	Mouth culture	Moist, 1 at time	3 min.	Charged on entering and after each min.
	(3)a	"	5	0	5	"	Dry, 1 at time	2 min.	Charged on entering and after each min.
	b	"	5	1	4	"	Moist, 1 at time	2 min.	Charged on entering and after each min.
	(4)a	"	6	0	6	"	Dry, 1 at time	1 min.	Charged on entering and after each min.
	(2)b	"	6	0	6	"	Moist, 1 at time	2 min.	Charged on entering and after each min.
	(3)b	"	6	0	6	"	Moist, 1 at time	2 min.	Charged on entering and after each min.
Duplicate	(1)a	Absorbent points	9	0	9	Mouth	Dry, 3 at time	40 sec.	Charged on entering
	b	"	9	0	9	"	Moist, 3 at time	40 sec.	" " "
	(2)a	"	9	0	9	"	Dry, 3 at time	40 sec.	Charged on entering & after 20 sec.
	b	"	9	0	9	"	Moist, 3 at time	40 sec.	Charged on entering & after 20 sec.
	(3)a	"	9	0	9	"	Dry, 3 at time	50 sec.	Charged on entering
	b	"	9	0	9	"	Moist, 3 at time	50 sec.	Charged on entering
	(4)a	"	9	0	9	"	Dry, 3 at time	50 sec.	Charged on entering & after 25 sec.
	b	"	9	0	9	"	Moist, 3 at time	50 sec.	Charged on entering & after 25 sec.
	(5)a	"	9	0	9	"	Dry, 3 at time	30 sec.	Charged on entering
	b	"	9	0	9	"	Moist, 3 at time	30 sec.	Charged on entering
	(6)a	"	9	0	9	"	Dry, 3 at time	30 sec.	Charged on entering & after 15 sec.
	b	"	9	0	9	"	Moist, 3 at time	30 sec.	Charged on entering & after 15 sec.
	(7)a	"	9	0	9	"	Dry, 3 at time	[illegible] sec.	Charged on entering
	b	"	9	0	9	"	Moist, 3 at time	20 sec.	Charged on entering
	(8)a	"	9	0	9	"	Dry, 3 at time	20 sec.	Charged on entering & after 10 sec.
	b	"	9	0	9	"	Moist, 3 at time	20 sec.	Charged on entering & after 10 sec.
	(9)a	"	9	1	8	"	Dry, 3 at time	15 sec.	Charged on entering
	b	"	9	8	1	"	Moist, 3 at time	15 sec.	Charged on entering
	(10)a	"	9	1	8	"	Dry, 3 at time	10 sec.	Charged on entering
	(10)b	"	9	8	1	"	Moist, 3 at time	10 sec.	Charged on entering
Duplicate	(9)a	"	9	0	9	"	Dry, 3 at time	15 sec.	Charged on entering
	b	"	9	0	9	"	Moist, 3 at time.	15 sec.	Charged on entering
	(10)a	"	9	1	8	"	Dry, 3 at time	10 sec.	Charged on entering
	(11)a	"	9	2	7	"	Dry, 3 at time	15 sec.	Charged on entering & after 5 and 10 sec.
	b	"	9	0	9	"	Moist, 3 at time	15 sec.	Charged on entering & after 5 and 10 sec.
	(12)a	"	9	0	9	"	Dry, 3 at time	20 sec.	Charged on entering & after every 5 sec.
	b	"	9	1	8	"	Moist, 3 at time	20 sec.	Charged on entering & after every 5 sec.
	(13)a	"	9	3	6	"	Dry, 3 at time	10 sec.	"
	b	"	9	1	8	"	Moist, 3 at time	10 sec.	"

points were completed. The instruments were inserted in different numbers, usually a few at a time for purposes of comparison with the other tests. The culture was a mixed one taken from the operator's mouth. The time required was from fifteen seconds to four minutes of actual exposure. The lowest time refers to absorbent points put in three at a time, dry, and charged with water only at the time of inserting; while the longest time was for burs, one at a time, dry, and charged each minute. In spite of the dry heat involved in the last, the burs were rusted by the exposure.

IV. Formaldehyde Gas.

Many dentists still use the formaldehyde gas cabinet as Holmes' report indicates. Tests with the device will aid us here in the establishment of a relative degree of efficiency.

The sterilizer uses a strong solution of formaldehyde in water. The gas is given off freely but tends to polymerize and reach an equilibrium. If the door of the cabinet is air tight the sterilizer is effective when fairly long periods of time are allowed, as compared with the sterilizers previously referred to. In the following experiments a glass cylinder is fitted with a glass cover about the edge of which is a rubber ring for sealing when the cover is swung closed. Shelves of galvanized iron wire are fitted in and the outfit used in a horizontal position. The formaldehyde is placed in petri dishes at the bottom, and used fresh each day in the form of a forty per cent aqueous solution (formalin 100%.) The following observations are with B. pyocyaneus and B. subtilis. (Table IV.)

TABLE IV.

Table IV gives the minimum time of sterilization.

Absorbent points	dry	1 hr.	B. pyocyaneus	4 hr.	B. Subtilis	30 days	observations
	wet	1½ hr.	"	2 hr.	"	" "	"
Burs assorted	dry	1 hr.	"	3 hr.	"	" "	"
	wet	?	"	? hr.	"	" "	"
Broaches	dry	1½ hr.	"	2 hr.	"	" "	"
Wrapt broaches	dry	2 hr.	"	? hr.	"	" "	"
Gutta-percha	dry	1 hr.	"	1½ hr.	"	" "	"
	wet	1½ hr.	"	1½ hr.	"	" "	"

TABLE V.

Efficiency of Sterilizers.

Minimum time for sterilization, comparative.

Instruments	BW	MM	SHS	S-HA	HCHO	Autoclave	HA-180
Burs (assorted)	25m	20s	1-2m	15m	3h	25m	1½h
Broaches (assorted)	20m	5s	1m	10m	2h	20m	"
Broaches (cotton)	....	10s	3m	20m	....	....	....
Abs. Points	....	10s	50s	20m	2-4h	....	....
Gutta-percha	....	....	....	15m	1½h	....	....

BW—Boiling water with Na_2CO_3
MM—Molten metal
SHS—Superheated steam
S-HA—Steam-hot air. Rochester type.
HCHO—Formaldehyde gas cabinet
Autoclave at 25 lbs. pressure
HA-180—Lautenschlager oven at 180°C
s—seconds; m—minutes; h—hours

All inoculated tubes have been observed over a period of at least thirty days because it has been found that many grow out after three weeks. This is due not to subsequent contamination in the incubator as might be possible but to inhibition of the microorganisms by the formaldehyde. Destruction is often not complete, and culture tube observations over a period of only two weeks have not been satisfactory in our tests. (Table V.)

V. Absorbent Points.

Previous tests of paper absorbent points (J. & J.) conducted in connection with other work at the Institute had indicated that the contents of intact boxes were not free from microorganisms. This year three careful tests have been made by different technicians using different technics. In the first two series of tests, points were found to contain microorganisms, a long bacillus stained by carbolfuchsin. The matter was then brought to the attention of the manufacturers who admitted that they had been unable to free the points from B. subtilis by their older method of sterilization. This organism, they indicated, was considered non-pathogenic. A new method had been developed by them to take care of the sterilization more effectively and two packages were tested in the Institute laboratory in a third series. This test has been extended to other packages now on the market and to packages once opened and kept for over four weeks under sterile conditions. The results are very satisfactory.

Series A. An intact box of points was taken and well wiped with a sterile towel soaked in bichloride of mercury solution (1:1000) and then left covered with the towel for a half hour before opening. Cleaned forceps sterilized in boiling water thirty minutes were used to open the box, flamed, and used to remove one point at a time, the box remaining within the folds of the towel. One hundred points were used, twenty-five from each compartment. The experiment was conducted with plain beef broth. Ninety tubes, containing one point each were found to have had organisms and to have developed after six days incubation. Ten other tubes with points, and ten control tubes without points yielded no indications of growth of organisms under the same conditions. Plating and transfer were used to check the media and growth as indicated by turbid, scummed, or clear liquid.

Series B. Three intact boxes were treated as in Series A and forty points were taken from each box. Dextrose beef broth and plain bouillon were used in duplicate for comparison of growth. In forty-eight hours the results indicated the presence of organisms in all tubes except the controls. A smear brought to light a pure culture of a long bacillus staining with carbol fuchsin.

Series C. (a) Two new boxes received from the manufacturers, after a new process of sterilization had been applied, were wiped with bichloride soaked towel and each carefully slipped from the paper protection with the aid of flamed tweezers and placed within the folds of a sterile towel. The cotton and paper protectors in each compartment were subdivided and six tests made of them. From one to four points were placed in each of six tubes of media for every section opened. The culture medium in this case was five per cent ascites-dextrose broth. There was slight trace of microorganisms (Table VI, C-a) from section protectors and none from the points, after two weeks incubation. One tube with a sample of a paper protector became slightly turbid.

(b) These same boxes were kept wrapt

in the same sterile towels for over four weeks on the laboratory table. After one week (Table VI, C-b, 1) a test, similar to (a), was made. Only points were used and there was again no indication of organisms. After four weeks (Table VI, C-b, 2) this test was repeated with the same result.

(c) Check tests of the last series were run under anaerobic conditions. The surface of the media in this series was covered with liquid paraffin. Absence of organisms was again indicated.

The following table gives the final results. At the present time, as this work indicates, the product appears to be free from microorganisms. The manufacturers have been cooperating, but tests of marketed goods at intervals will serve to further indicate what reliance is to be placed upon these goods. (Table VI.)

TABLE VI.

Absorbent Points.

Series A	100 tubes	6 days total time	90 positive	10 negative	Beef Broth
" B	120 "	48 hours " "	120 "	0 "	Dextrose Broth
" Ca	54 "	2 weeks " "	1 "	53 "	Ascites-dextrose
" Db-1	24 "	2 weeks " "	0 "	24 "	"
" b-2	32 "	7 days " "	0 "	32 "	"

EFFICIENCY OF STERILIZERS.

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MOTTLED ENAMEL: A FURTHER CONSIDERATION OF AN ENDEMIC ARTESIAN DISTRICT IN VIRGINIA, TOGETHER WITH DATA RELATIVE TO THE BRAVA PEOPLE, CAPE VERDE ISLANDS.

By Frederick S. McKay, D.D.S., New York City.

(Read before the National Dental Association at Its Twenty-Second Annual Session, Chicago, Ill., August 5-9, 1918.)

THE endemic field in Virginia as first brought to our notice by Dr. W. H. Arthur (Dental Cosmos, 1916,) is included principally in the towns of Franklin and Courtland, lying between the Blackwater and Nottoway Rivers and is situated over an artesian basin, from which the domestic water supply is drawn, the first wells having been sunk about 1887.

Altho Dr. Arthur's report of conditions in this district was made in a very comprehensive manner, additional examination was thought necessary particularly in view of the close association between this lesion of the enamel and the use of artesian water, established by this research in South Dakota. (Journal N. D. A., July, 1918.)

It was noted at the time that Dr. Arthur's report indicated a most confusing relationship existing between the occurrence of the enamel lesion and the use of water from certain of the artesian wells.

This feeling was also experienced during the examination of this district which was made by Professors Rudd, Miller and Simpson of Richmond. (Dental Cosmos, 1916.)

Examination of Franklin, Va.

The examination was conducted as usual in the Public School, omitting the lower grades.

The data obtained there were only relatively conclusive; for instance—13 cases of normal enamel were noted, 5 of whom had been raised on shallow or "dug" wells and 8 on artesian water.

On the other hand 16 cases of mottled enamel were found who had been raised exclusively on artesian water.

In a general way therefore it could be said that the occurrence of the lesion, which was entirely typical, was associated with the use of artesian water.

It is certainly true that no case of the lesion was found which was associated with the use of water other than artesian, except that Dr. Arthur states that he has knowledge of 3 typical cases which antedate the artesian wells, and were therefore associated with the use of "shallow" well water.

The confusing feature is, that the use of artesian water, in some instances from the same well, has produced in some individuals typical and even extreme cases of the lesion, and in others, normality of the enamel, as will later be shown.

This circumstance is brought about by the use of a "neighborhood" well by two or more families.

A peculiar variation in results is shown in the instance of the following three children who made continuous use of the same artesian well during the years of enamel growth.

Esther S., born 1900—enamel normal.

Sadie F., born 1901—lesion slight.

Lloyd D., born 1904—lesion pronounced and typical.

VAUGHN WELL—VAUGHN FAMILY.

Four children were raised on this well as follows:

Girl, age 29, born 1888—typical case.

Girl, age 27, born 1890—typical case.

Boy, age 24, born 1893—extreme case.

Girl, age 21, born 1896—slight case.

Between 1888 and 1896 this well produced three cases, all typical but after 1896 its influence seems to have waned.

WATKINS WELL—PETERS FAMILY.

Between 1892 and 1909, five children were associated with this well.

Oldest child, age 25, born 1892—typical case.

Next 3 children, born between 1893 and 1908—typical cases.

Youngest child, age 8, born 1909—slight case.

Can we say here that the influence of this well is shown to have suddenly become inactive since the birth of the fourth child in 1908, as the fifth child born in 1909 was unaffected?

WATKINS WELL.

The history of this well is curious and interesting inasmuch as six children in three different families derived their water supply from it during the enamel growing years, it being what was termed a "neighborhood" well.

George W., age 26, born 1891—typical case.

Girl, D., age 21, born 1896—normal.

Boy, P., age 17, born 1900—typical case.

Girl, D., age 16, born 1901—typical case.

Robert D., age 12, born 1905—typical case.

Lucille P., age 12, born 1905—slight case.

Beginning with 1891 this well produced a typical case; after 1896 a normal case; in 1900 and 1901 two more typical cases and in 1905 we find two children in different families born into its influence, one of whom is typically marked and the other very slightly.

Looking at it from the family standpoint we note that the first victim born in 1891 was badly marked.

In the D——family the girl born in 1896 grew normal enamel, but the second girl, born in 1901, and the boy, born in 1905, were both marked.

In the P—— family the boy born in 1900, was typically marked, but the girl in 1905 was only slightly so.

Shall we say here that the pernicious influence of the water was active in 1891, waned in 1896, became active again thru 1900 to 1905, and diminished again thereafter? If so, how shall we account for the totally different effect produced on the two children born in 1905?

PACE WELL—P.——FAMILY.

The "log" of this well is equally interesting.

Delia, age 29, born 1888—normal.

William, age 26, born 1891—slight case.

James, age 24, born 1893—typical case.

Frank, age 20, born 1897—slight case.

3 younger children, born since 1897—practically normal.

The "curve" of influence of this well seems to start with normality in 1888, gradually rise to a "peak" of abnormality in 1893 and fade away into normality again after 1897.

The same can be said of the "Old Hotel" well in the history of the B——children.

Oldest, age 26, born 1891—normal.

Second, age 24, born 1893—typical case.

Third, age 21, born 1896—normal.

The height of this "curve" of lesion production is similarly in 1893.

IN THE CAMP WELL—C.——FAMILY.

Boy, age 27, born 1890—typical case.

Girl, age 21, born 1896—slight case.

"Post Office" Well.

This well was used by eight children in the L——family whose ages range from 14 to about 29. In other words, the well was used beginning about 1888 up until about 1903.

The first four children were marked, the next two had enamel that was practically normal; the seventh child, Elizabeth, used the well beginning in 1901 and a typical case of the lesion was developed. A younger brother is also marked.

"Parker" Well.

This was one of the first wells to be sunk and gives an interesting history concerning six children as follows:

Mary, age 27, born 1890—typical case.

John C., age 23, born 1894—normal.

Alex, age 19, born 1898—slight.

Sister, age 17, born 1900—mottled.

Sister, age 15, born 1902—slight.

Gilbert, age 12, born 1905—normal.

This well starts in 1890 by producing a typical case; the second child, born 4 years later, escapes all damage; its influence apparently increases thru 1898 with a "flare-up" in 1890 and diminishes again to normality after 1905.

"Holland" Well.

We find five children associated with this well.

Stanley, age 20, born 1897—normal.

Maria, age 17, born 1900—normal.

William, age 15, born 1902—typical case.

Joel, age 12, born 1905—slight.

Margaret B., age 12, born 1905—normal.

From normality in the first two children the association with this well changes after 1902 to produce a typical case and fades away to practical normality again after 1905. Note also that the child in another family who used this well also escapes damage at that time.

Another Well.

This well has no particular name by which to designate it but gives the following history:

Two older daughters of the Holland family just described (ages 27 and 25) used this well after 1890 and 1892 respectively and developed typical cases; two adult sisters in another Parker family, using the same well, developed normal enamel while a younger Parker child, Inez, born 1905, presents a typical case on the same well.

This well starts with typical production, changes to normality and again becomes a producer.

From such confused and contradictory data as the preceding no conclusions are possible, except as before stated, no cases of the lesion were noted that had been associated with other than artesian water.

If any summarization were attempted it would show that in association with artesian water the period from the beginning of its use in 1888 to about 1893 was one of lesion production, records of eleven pronounced cases occurring in this period with two normal cases and one slight case.

From 1893 up to 1900 we have no observation of production but 6 normal cases and 5 slight cases.

Then commencing again in 1900 is another active period with 13 cases, but during the same period up to 1906 against these are 10 normal and 9 slight cases.

Of course it is to be understood that an actual canvass of every native living thru these periods might show very different results, but the data which it was possible to collect in the time available gives the results as stated above.

As an hypothesis then, to account for the varying effects of these waters upon the different individuals, we assume either that the waters underwent some sort of change in their chemical or other factors from time to time which were re-

lated to their lesion productiveness, or else that the physiological attributes or activities of the associated individuals were such as enabled some to escape, while others suffered damage to the growing enamel while subject to the same influence.

In this latter connection however it is remarkable that in no other districts properly considered endemic, excepting possibly that described as the "P" valley (Dental Cosmos, 1916,) were there any such possible physiologic differences, the rule being that practically all persons growing their enamel in the same environment were afflicted with the lesion in the same typical manner.

Observation of the Brava People at Nantucket Island, Mass.

The widespread geographical distribution, far beyond what was originally considered likely, has been alluded to in our previous published articles, and is strikingly emphasized by Dr. Rand's report concerning the Brava People observed by him at Nantucket. (Journal N. D. A.)

My own observations were made in November, 1917, at Nantucket, to confirm Dr. Rand's report and were as follows:

A more or less localized immigration of these people has occurred to the Cape Cod region of Massachusetts where they are employed in various capacities as unskilled labor and in no one place could any considerable number be observed.

In order to see what few are reported it was necessary to visit their houses in the evening where they submitted with varying degrees of grace to our examination, mostly by lamplight, but even in this hasty and unsatisfactory manner, it was evident that the lesion of the enamel was identical with that previously described except that these cases were of the most extreme character. In fact, all thru this investigation, I have never seen such utterly disfigured and repulsive looking teeth.

It is no exaggeration to say that in most instances they were as dark as the darkest chocolate, in one or two cases almost black, and with labial surfaces extensively "corroded" or pitted with confluent depressions. Their use of English being limited I was able to get only fragmentary accounts of their childhood conditions but found it to be a fact that those exhibiting the lesion invariably came from the Island of Brava.

Quite a percentage of these Cape Verde Island people at Nantucket came from the Island of Fogo which is only nine miles from Brava, but these Fogoites seemed immune to the enamel lesion, or at least none were found who had other than normal enamel. The contrast in this respect between those from Brava and those from Fogo was remarkable and conclusive.

It is with great regret that I am unable to submit photographs of any of these cases. Most of these people are employed at various places in the village where it was impossible to reach them for this purpose. As a rule they flatly refused to allow any pictures to be taken, but one man agreed to allow me to get a picture the next day.

I found him at work at a livery stable but on presenting myself the next morning I found that he had reconsidered, and due to the superstitious objections of the women of the family, to having a picture taken, was obdurate, refusing any bribe of money which I felt justified in offering.

The following cases are presented in some detail to particularize our observations:

Julia Pina, born in Brava, lived there till 25 years of age, extremely bad case, teeth being almost black. Used spring water.

Another Brava woman had teeth which were moderately stained.

Rosie Viera, born in Brava, lived there until 16 years of age, teeth extremely dark, used spring water.

Joseph Nichols, born in Brava, lived there till 16, bad case and teeth pitted.

John Nichols, a brother, lived in Brava till 15, in this case the stain had almost worn off, but still showed. Both used spring water.

Manual Gomez, born in Brava, left at 17, teeth slightly mottled, but not stained nor pitted.

It is interesting to note that this boy used the same spring as the two Nichols brothers yet escaped the lesion. Speaking of using the same water he said that it was necessary as it was three miles to the next spring.

Manuel Neves, born in Brava, left at 17, teeth typically marked, used spring water.

It was evident that there was no other source of water except from springs, altho water for use in the village comes down from the mountain and is stored in a stone tank.

From what I could learn, water from springs is also used on the Island of Fogo which is, as before stated, non-endemic.

In an effort to obtain first hand information bearing upon conditions upon the Island of Brava, I addressed an inquiry to the Portugese Legation at Washington and after about fifteen months I received a series of reports from various physicians in the Islands thru the Minister of Colonies at Lisbon which I summarize as follows:

"In certain inhabitants of Brava, I have noticed teeth affected as if corroded with more or less dark spots, the cause of which I have not yet discovered."

Dr. J. G. Pinto.

"In Brava is where the inhabitants seem to have the teeth more or less discolored or rather colored dark, and this is said to be caused by the alkaline waters, or waters with much calcium which they use." Dr. Viera.

"In the Island of Brava there is a place called Braga, in which a large part of the inhabitants show dark yellow (teeth), for which I do not know the reason. As a result it is said that the inhabitants of Brava have teeth altered and ugly, this being due to the use of water from the "Vinagre" As a matter of fact it is not true that such an alteration is observed in the whole island, neither is it true that it is caused by the use of the water from the "Vinagre" as the people of Brava do not drink that water, for the reason that it is distant and they have good water to drink."

Dr. Areal.

"There are in fact, many people in Brava with bad teeth, the alteration of which is in the enamel, which becomes dark and ugly, and rough, a condition noted by all visitors to the Island. * * * Some ascribe the deterioration of the teeth to the prolonged use of the water from the "Vinagre," and carbonic acid and other matters which it contains, might corrode and alter the enamel, but I am not of this opinion because the inhabitants of S. Joao Baptista are the only ones that use the water from the "Vinagre" and those who have black and disfigured teeth in the largest percentage are from Nossa Sinhora do Monta."

Dr. Loureiro Dias.

"The natives of Cape Verde generally have good teeth except the natives of Brava, the alterations of whose teeth are well known. I do not know the cause of this, which some attribute to the use of the waters of that Island."

Dr. Monteiro Filipa.

"In the Island of Brava the majority of the population have bad teeth, black and rotten, spoiling sometimes the appearance of handsome faces."

Not signed.

The conclusions from these reports are that it is only in the Island of Brava that this defect exists and that it is generally supposed to be due to the water used.

The translation was made by the cour-

tesy of the Portugese Consul in New York.

While the recital of the foregoing is interesting as showing the wide geographical distribution and localization of this lesion and emphasizing also its endemic character, we feel that it has brought us no nearer to the discovery of the causative factor, altho we believe that it is plain that this factor is identical in the various districts in which it operates, for the reason that as has been before stated, the lesion takes on a precisely similar appearance and the same characteristics in the widely separated districts in which it occurs.

This fact having been established it is clear that the problem is to determine the factor or group of factors operating upon growing enamel in these various districts that produces the lesion.

Starting from a point of merest suspicion, we have come to the firmest conviction supported by conclusive evidence, that the causative factor is contained in the water used during enamel growth.

Analytical determinations of the chemical constituents of several waters have proved to be inconclusive because of two reasons, to-wit: Either because of our ignorance of the effect of certain chemical substances upon the process of enamel calcification because of no previous investigation of this problem of which I am aware, or else because the nature of our analysis was not sufficiently finely drawn to give the exact chemical nature of these waters.

Obviously, a new line of attack must be resorted to.

In line with this policy, during the winter and spring of 1917, I collected in the most careful manner possible a gallon of water from each of the sources mentioned below and shipped to the laboratory of the Research Institute for chemical analysis.

1. From Pictou, Colorado (designated "V" in Dental Cosmos, 1916, and described therein.)

2. From Little Fountain Creek at Keeton Ranch, Colorado, upon which a family of ten children were born and grew to maturity, all of whom exhibited the lesion in a most pronounced form and whose sole source of water supply during the years of enamel growth was from the creek named.

3. From the Hardina Ranch at Kidder, S. Dakota, (See Journal N. D. A., July, 1918), collected by Dr. Martin.

4. From the Hamilton well at Britton, S. Dakota, (See Journal N. D. A., July, 1918), collected by Dr. Martin.

5. From Sigle Ranch, Estabrook, Colorado. (See Dental Cosmos, 1916.)

It is understood that locations 1, 2 and 5 have pronounced associations with the lesion and the water from 3 and 4 stand in direct contrast, with each other, altho taken from the same general district, No. 3 being from an artesion well having a most intimate lesional history, while No. 4 is associated with absolute normality of the enamel, being from a shallow well.

It was found that the character of analysis required could only be performed in a laboratory having a most complete equipment and by an analyst who had had large experience in this class of analyses.

Thus far it has not been possible to get the required work done.

It has been pointed out that a very likely method of determination of suspected water would be to select an aquatic plant that would derive its entire sustenance from the water and grow in water whose elements we wished to determine.

Such a plant would collect from the water a certain amount of each constituent, no matter how minute a quantity the water contained, and if my understanding is correct the analysis of the plant would be a comparatively simple matter.

Our plan would be in following this experiment to grow the plant in a "susceptible" water and also as a "control" or contrast in an "immune" water, or several of such.

Certainly plants grown in water from the Hardina artesian well must show a difference upon analysis from the same species grown in water from the Hamilton well. These two waters will be used in the experiment.

It is our belief that the future work in the investigation of this problem must be done largely in the laboratory.

It is with particular interest and gratification that we call attention to the work of Gies and his collaborators at Columbia University as reported at the meeting of the N. D. A. at New York, October 25, 1917 (Journal of the N. D. A., July, 1918), while not directed specially at this lesion of the enamel, yet so closely related with it as to seem like an extension of the same investigation.

The experiments reported by Gies were upon dogs and in brief were as follows:

Several dogs were injected intraperitoneally with trypan blue which gaining entrance into the soft tissues thru the circulation rendered them a deep blue color.

Dog No. 1 was the control and had no injection.

Dog No. 2 was injected after the permanent teeth had attained full development; the teeth remained normal in color but gums and skin were deep blue.

Analogous to this from the standpoint of our experience with mottled enamel, is the individual who has developed the entire enamel of a given group of teeth in non-endemic territory, but who later comes into an endemic district, the completely formed enamel undergoing no change and no penetration of "brownin" into the formed enamel.

Dog No. 3. "Trypan blue injected after the development of the permanent teeth had been far advanced, but before attainment of full size. Teeth normal white except in a narrow blue zone above the gum line, extending about one-fourth the distance to the occlusal surface. The gums and skin were moderately blue in color."

The analogue of this is the individual who comes into an endemic district with the enamel on a given group of teeth developed up to a certain point. Immediately upon entrance into such a district is the forming enamel acted upon by the influence for which we are searching with the result that upon eruption a sharp line separating the normal from the defective enamel is observed, closely indicating the age at which that person entered the afflicted district. This feature of the condition has been repeatedly pointed out in our previous writings upon this subject.

Dog No. 4. "Trypan blue injected soon after the permanent teeth had begun to form. Teeth normal white except in a wide blue zone extending about three-fourths of the distance from the gum line to the occlusal surface. The gums and skin were slightly blue in color."

This is precisely the case of the person who comes into an afflicted district at an earlier stage of enamel development than the one described under Dog No. 3. Less normal enamel had developed before the "disturbance" occurred.

Dog No. 5. "Trypan blue injected before the permanent teeth had begun to form. Teeth blue over entire surface of each crown; enamel on occlusal surfaces (crests) deficient in amount and abnormal in appearance. The gums and skin were almost imperceptibly blue."

This of course corresponds to the native of an endemic district (or one who came into such a district in early infancy.) No enamel has formed prior, hence the entire enamel is deficient in development and constitutes the lesion in its typical expression.

In summarizing the results of these

experiments, Gies goes on to state that "trypan blue, after its absorption into the blood, had passed into, and been permanently retained in, a definite portion of the enamel of each permanent tooth, during the period of the formation of that enamel, but that the blue pigment did not enter any enamel that had been formed before the time of the initial injection of the coloring matter, regardless of the length of the period following such injection, and prior to the eruption of the teeth."

Gies states further with some reservation that "substances in the blood may be permanently incorporated into, and may materially affect directly the quality of dental enamel, during the period of enamel development."

That this work of Gies is a most convincing corroboration of our position on the question of mottled enamel and its penetration by "brownin" is hereby set forth with great satisfaction and his added data concerning two other dogs "A" and "B" which were exhibited at the same time still further strengthens our position.

If in our further prosecution of this problem a constant suspicious element could be determined in the various suspected waters, experiments could be carried on which might produce artificially the lesion in a group of animals, it would then seem that we had approached very near to the determination of the cause of what has been a most obscure and elusive condition.

PRELIMINARY REPORT ON BACTERIA FOUND IN APICAL TISSUES AND PULP OF EXTRACTED TEETH.

By K. R. Collins, M.D., and H. C. Lyne, B.S.

(From the Laboratories of the Research Institute, National Dental Association.)

IN THIS preliminary study an effort has been made to determine the bacteria present in the pulp and apical regions of teeth which have been extracted for various causes. As the time allotted for this work has been limited and the purpose has been merely one of orientation, fundamental to the further study of apical and pulp infections, the procedures have been restricted to the determination of types, their relative occurrence and the frequency with which bacteria are found in these tissues.

Method of Collecting and Treatment of Teeth.

Small flat-bottomed test tubes, 70 mm. in length by 2 mm. in diameter, were filled to the depth of 20 mm. with a mixture of one part paraffin, and of five parts vaseline. The tubes were plugged with cotton, autoclaved and cooled in an upright position.

This mixture is of a consistency that admits of the tooth being firmly and readily planted in the position desired and the tube can be transported without dislodgement of the tooth.

The obtaining of teeth without contamination of the root surfaces from the gingival tissues as they were withdrawn, presented the greatest technical difficulties. The method that proved the most satisfactory from a practical standpoint was the use of iodin upon the gums be-

fore extraction. While this was not an ideal procedure, still by various checks which will be discussed later, we were able to establish fairly accurate controls.

With a pair of moderately long stout sterilized forceps, the tooth was taken from the dentist's forceps immediately after withdrawal by grasping the root firmly. The tooth was thus in such a position that the crown could be planted to about two-thirds of its depth in the paraffin mixture. Care was taken to avoid touching the sides of the tube with the crown of the tooth while introducing it.

A separate pair of forceps was used for each tooth. Each pair of forceps was sterilized in a test tube, the handle protruding a couple of inches above the opening which was plugged with cotton. The forceps could then readily be withdrawn as needed and after use placed back in the tube.

A solid wooden block, 10 in. x 3¾ in. x 3¾ in. dimensions with a sufficient number of holes of desired depth and properly spaced to hold both the tubes of the paraffin mixture and the forceps, furnished a convenient stand which could be carried and set up for use without delay, either in the clinic or the dentist's office.

The teeth were treated as soon as possible after extraction. This was essential as it was found that when the blood, which was sometimes in excess, was allowed to dry the examination of the apical tissues could not be properly carried out.

The tooth was withdrawn from the tube with sterile forceps, placed carefully in a sterile petri dish, described, the crown was then firmly held in an inlay holder. (A small piece of sterile gauze wrapped about the crown insured a firmer grasp.) The tooth could then be handled quite easily. By scraping the apex with broaches, material was obtained for smears and culturing.

Dextrose agar with defibrinated rabbit's blood was used for plating. The sterility of the blood was controlled each time. Also oxygen tension plates according to Wherry were made in some instances but did not seem to offer any advantage over the above method. Anaerobic tube cultures were used also but added nothing to the plate method.

After the examination of the surface was made the tooth was dipped in equal parts of methyl alcohol and turpentine and flamed. This sufficed to sterilize the outside of the root. The crown again held by the inlay holder, the root was split with excising forceps in the longitudinal direction. The root canal was thus well exposed. If the canal contained pulp, smears and plates were made as above. If the canal appeared empty the wall was scraped with a broach and the scrapings examined. In some instances the amount of material obtained thus was not sufficient for a full examination.

Where definite granulomas (or circumscribed inflammatory tissue) existed, the surface of these being sterilized by the flaming, were opened and an examination made of the center of the area.

Plates were read at the end of twenty-four hours and again at the end of forty-eight hours. Sufficient culturing was carried on to determine whether the organisms were streptococci or not.

The fusiform bacillus was determined by its morphology which is quite characteristic, together with the spirochete that frequently accompanies it.

To determine the organisms present on the gingival tissues, swabs were taken from the gums in several instances and examined as above.

Forty-nine cases were examined in all, while the total number of teeth obtained was ninety-four. Three were discarded on account of being too crushed for our use.

In our opinion, the observations made justify the classification of the cases examined into two broad divisions: first,

those with abnormal gingival tissues, from simple irritation to the more severe forms with pus and calcareous deposits, and second, those in which the gingival tissues are normal in appearance.

Under these two heads, we have the subdivisions into teeth which have carious, filled or normal crowns. These are again subdivided into such teeth as have normal or abnormal apices.

To control the possible contamination from the gingival tissues as the tooth was withdrawn all cases where the smears failed to show the presence of organisms were not considered as positive, tho the plates may have shown growth later. The contact contamination could be assumed under the circumstances to be too slight to show up in a smear made within a short time following extraction, but would appear in culture media after several hours.

In the following table the percentage of positive bacteria findings is noted, based on the number of examples coming under the particular heading:

TABLE I.

	Abnormal Apices			Normal Apices		
	No. of cases	Surface of Apex	Pulp	No. of cases	Surface of Apex	Pulp
Irritated gums with carious crowns	2	50%	50%	8	62½%	25%
Normal gums with carious crowns	4	100%	75%	3	33⅓%	0
Irritated gums with filled crowns	11	63.6%	27.2%	6	50%	0
Normal gums with filled crowns	4	75%	0	4	0	0
Irritated gums with normal crowns	7	85.7%	14.2%	13	53.8%	0
Normal gums with normal crowns	0	0	0	0	0	0

It will be seen by the foregoing figures that the bacterial findings are not always consistent with the conditions of the tooth itself or its environment. There are two main factors which play a part in this inconsistency that must be considered before any reasonable interpretation can be placed upon the results.

The first is the number of cases involved which in each division is too few to admit of a final conclusion and second, the different degrees of irritation of the gingival tissues that may have existed in the various examples. If in one case there exists extensive involvement of the gingival tissues and in another case only slight irritation of these same tissues, the opportunities for infection of the apex while the tooth remains in situ or by contamination at the time of extraction must differ widely.

So in order to adjust this obstacle to a proper scientific study of the subject in this particular phase, an investigator needs controlled clinical material for satisfactory work.

The findings in the pulp in these cases offer more consistent results and are what might be expected under the various conditions considered.

It is interesting to note the results from the pulp of teeth in which the apices of the roots show irritation. The percentages of bacterial findings are higher in the cases where caries of the crown exists than in the filled or normal crowns and are entirely lacking in those teeth where the crowns are filled or normal and where the gingival tissues are normal. Where the apices of the root are normal, bacteria were found in the pulp of those teeth having carious crowns and irritated gums.

In the table that follows, the relative frequency with which the different organisms were found alone or in various combinations is given.

In order to avoid confusion the simple classification of irritated and normal gingival tissues is used.

TABLE II.

Types of Organisms found		Frequency	
		In apical tissues or surface of apex	In Pulp
Irritated gingival tissues. No. of cases—73.			
B. fusiformis	alone	6.8%	1.3%
	combined with st. viridans	13.6%	4.1%
	combined with st. viridans and spirochetes	10.9%	1.3%
	combined with st. viridans and st. hemolyticus	10.9%	0
Gingival tissue normal. No. of cases—18.			
B. fusiformis	alone	5.5%	0
	combined with st. viridans	16.6%	0
	combined with st. viridans and spirochetes	5.5%	11.1%
	combined with st. viridans and st. hemolyticus	0	0
Irritated gingival tissues. No. of cases—73.			
St. viridans	alone	13.6%	1.3%
	combined with st. hemolyticus	8.2%	1.3%
Normal gingival tissues. No. of cases—18.			
St. viridans	alone	22.2%	5.5%
	combined with st. hemolyticus	27.7%	5.5%

In one case of granuloma of the apex the streptococcus viridans alone was found in the center of the mass, while in another case the streptococcus viridans and the streptococcus hemolyticus were found.

The total number of teeth from cases with iritated gums was seventy-three, while those with normal gums was eighteen. In two cases a small unidentified bacillus was found in the apical tissues and pulp. In one case a strepto bacillus was found in the apical tissues.

The above figures indicate, as far as these observations go, that in dealing with periapical and pulp infections a variety of organisms must be considered in the determination of the etiology of these conditions and also the possibility of the organisms found being primary or secondary invaders.

We have plenty of evidence that there are two avenues of invasion; one, thru the pulp or root-canal in carious conditions of teeth, filled or unfilled, and the other, by extension from diseased gingival tissues, and reasoning by analogy there is ample ground for assuming a hematogenous route for such bacteria as possess the requisite invasive powers.

We desire to extend our thanks to the members of the advisory committee, Doctors Guy D. Lovett and S. F. Hirsch, for their very valuable suggestions and criticisms of our work.

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Editorial Department.

THE DENTAL HYGIENIST.

It is becoming more and more apparent that there is a need for the Dental Hygienist in the regeneration of the mouths of the American people. A prominent member of the dental profession made the statement some years ago, that if all the calculus on the teeth of the people of the United States were removed, it would require the combined efforts of every dentist then in practice, working all the time to accomplish this object; and it is quite within the bounds to say that even after all

this expenditure of effort, there would still remain much calculus left. But at that time there was little likelihood of the profession being called upon to perform this herculean task, simply for the reason that the large mass of the American people were not educated to the necessity of giving attention to the teeth. It was claimed at the time that only twenty per cent of the population sought the services of the dentist for anything except the extraction of aching teeth, and while this estimate may have been above or below the mark, the fact remains that the large majority of the people did not recognize the real value of dental service.

Under these circumstances, the profession in general was quite able to care for all the work that came to it, and there was at times even the claim that the profession was overcrowded. But in recent years all this has changed. The public is being rapidly educated regarding the significance of the teeth to the human economy, and the profession has not increased in members sufficiently to meet the increased demand for dental service. We have, as it were, been "hoist on our own petard."

Municipalities, school boards and other bodies having in charge the welfare of the rising generation, are recognizing more and more the value of having the mouths of children kept clean, but the dentist of today seldom has the time in the routine of his daily work to give the necessary attention to cleaning teeth.

It is here that the Dental Hygienist will fill an important place in assisting the profession to keep the teeth of the American people free from deleterious deposits. This work is always of great educational value, and particularly when performed for children, it tends toward the prevention of dental and other diseases. This fact is being so generally recognized that in some states the laws have been amended to permit the Dental Hygienist to perform this important work, and the information comes from these States that the plan is working exceedingly well. Manifestly if the profession cannot adequately take care of this prophylactic work, then it is only logical to call in some agency to assist in it, and the lady hygienist seems the most feasible medium thru which this may be accomplished.

When this idea was first advanced, there was fear in some quarters that the privileges accorded the lady hygienist in the way of cleaning teeth, would be abused and extended into the performance of dental operations of all kinds, but so far in those states where she has been at work for several years, there seems to be no complaint whatever of her exceeding her legitimate prerogative.

No one can be found who will deny the crying need of a more gen-

eral employment of oral prophylaxis among our people. No one can claim that the profession today, with all the intense activity for which its members are noted, is able to adequately meet the need. No one can deny that this work may not be acceptably done by the Dental Hygienist if properly educated along these lines. Then why not educate her, license her, and permit her to do it?

INTRODUCING THE WISE AND THRIFTY AMERICAN CITIZEN.

Up to within the last few years the folks you knew were just plain folks. They were inhabitants rather than citizens of this country. This is no longer the case. A war has intervened. A new era is at hand.

Let us introduce you to your new neighbor—Mr. W. T. American.

His first name is Wise.

His second name is Thrifty.

He is part owner of the United States Government, and is therefore an entirely different kind of a citizen than he used to be, which is why he has earned the right to use his last name.

There are 20,000,000 such people—your own family, your friends, your neighbors and your fellow countrymen.

From now on you are going to look at life thru National spectacles, and a whole lot of things will be done differently—because you are an American—because you are going to live up to American ideas and ideals.

First off, you are going to see that this country—your country—lives up to its war contracted obligations. National success has become a personal matter with you. Where you can and when you can, you will increase your holdings of government securities—bonds, war savings stamps.

But you are going beyond this.

You are going to make America, individually as well as nationally, the most prosperous and powerful nation in the world.

It will not be difficult for you to accomplish this. It means no sacrifice on your part. On the contrary, it means that you will get more out of life than you ever before did.

Here is how you can bring this about:

When you buy anything, get full value for what you spend. You need food and clothing. You need entertainment. Get what you need—

but see that you get real value for your money. Do not buy foolishly or carelessly, and do not buy things for which you have no use.

Invest safely. Your government now offers you the opportunity to secure interest—good interest—on very small amounts—and the investment is the safest in the world: W. S. S. Buy them.

Invest in government bonds. Look very carefully into the character of the investment you made.

Save wisely.

No matter how little you put by, put by something. Save regularly—only one thrift stamp a day will amount to a mighty considerable sum in the course of a year. You will see how you as an individual will benefit by following out this program. At the same time you will be aiding your government and exhibiting the highest type of patriotism.

We wonder—have we introduced you to yourself?

AN INVITATION

TO EVERY MEMBER OF THE

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TO ATTEND THE TWENTY-THIRD

ANNUAL SESSION OF THE ASSOCIATION

OCTOBER 20, 21, 22, 23, 24,
1919,

in

NEW ORLEANS, LOUISIANA.

"DENTISTRY MUST PLAY ITS PART IN THE ERA OF RECONSTRUCTION."

C. V. VIGNES, President.

JOSEPH P. WAHL, Chairman Local Committee.

Army and Navy

NAVAL DENTAL OFFICERS TEMPORARILY PROMOTED.

The comptroller holds that a dental corps officer given a temporary promotion in rank by virtue of the act of July 1, 1918, is entitled to the pay and allowances thereof from the date stated in the temporary appointment or from the date of the approval of the act. The case presented was that of Lieutenant Commander H. W. Blaisdell, passed assistant dental surgeon, who was given a temporary advancement in rank by orders of September 8. The comptroller says:

"The act of August 29, 1916, provided three ranks for dental surgeons, the same being based upon length of service, viz., those with less than five years' service the rank of lieutenant (junior grade), those with five years' service, but less than twenty years' service, the rank of lieutenant, and those with more than twenty years' service the rank of lieutenant commander. The act of July 1, 1918, which repealed all acts inconsistent therewith, provides three grades for dental officers of the Navy, viz, assistant dental surgeons passed assistant dental surgeons, and dental surgeons, and also changed the requirements relative to the rank of said officers. Instead of basing the rank of dental officers upon length of service it provides that they 'shall be eligible for advancement in grade and rank in the same manner and under the same conditions as officers of the naval medical corps with or next after whom they take precedence and shall receive the same pay and allowances as officers of corresponding rank and length of service in the naval medical corps up to and including the rank of lieutenant commander.'

"It is apparent that this act assimilates the rank (within the limitation stated), also the pay and allowances, of all officers in the dental corps on July 1, 1918, to the rank, pay, and allowances of officers of the naval medical corps of corresponding rank and length of service.

"Unless explicitly so declared in the act or unless such intention appears by necessary implication from the nature and wording of the act, statutes should not be construed to be retroactively effective as to pay and allowances. In this case the date of advancement in rank is prior to the date of the statute authorizing such advancement, and unless the statute clearly so provides, the officer is not entitled to the pay and allowances of the advanced rank prior to the date of the statute.

"As stated above, the prior statute based the rank of such officers upon length of service, but this statute assimilates their rank to the rank of 'officers of the naval medical corps with or next after whom they take precedence.' The officer of the naval medical corps with or next after whom Lieutenant Commander Blaisdell took precedence—that is, his

'running mate'—attained the rank of lieutenant commander on February 1, 1918. The apparent purpose of the statute is to confer on dental surgeons the same right to advancement in rank (within certain limitations) as is enjoyed by officers of the medical corps, by giving each dental officer a 'running mate' the one with or next after whom he takes precedence), and when the running mate is advanced in rank the dental officer is entitled to the same advancement. In this case Lieutenant Commander Blaisdell's running mate was advanced in rank from February 1, 1918, and in order to give effect to the statute which conferred upon him rank 'in the same manner and under the same conditions' as his running mate. Lieutenant Commander Blaisdell was advanced and placed on the list of lieutenant commanders as taking rank and precedence from said date. To take rank with his running mate he must take rank at the same time—that is, on the same date. The letter of the Secretary of the Navy is not a commission, but in effect it is notice to the officer that, in accordance with the terms of the statute, he would take rank and precedence on the list of lieutenant commanders from and including February 1, 1918. The officer's right to advanced pay and allowances prior to July 1, 1918, depends upon the terms of the statute and not upon the secretary's action.

"The advancement in rank and precedence authorized by the statute determines the officer's relative position on the list, but does not require, or imply, that it shall carry retroactively advanced pay and allowances.

"The concluding clause of the statute provides that the officer 'shall receive the same pay and allowances as officers of corresponding rank and length of service in the naval medical corps.'

"There is nothing in the wording of this clause, or in the context or other related statutes, which negatives the ordinary rule of construction that the authorization to receive pay and allowances thereunder becomes operative from and after the approval of the act."—*Army and Navy Register, March 15.*

ARMY MEDICAL CORPS APPOINTMENTS.

The president before his departure for France on March 5 made recess appointments of all officers of the Army and Navy whose nominations had failed of senatorial confirmation at the time of the adjournment of the 65th Congress on Tuesday. Most of these left-over nominations were those of officers who were due for promotion in the regular order of things, but two of them were of special importance—those of Colonel Walter D. McCaw and Lieutenant Colonel Robert E. Noble (temporary major general), Army medical corps, to be permanent brigadier generals of that branch to fill the two vacancies created by the act of Congress of July 9, 1918. The President has issued recess appointments in both cases. It will be necessary, of course, for the president to renominate them at the beginning of the next session of Congress, when will be renewed the fight in the Senate military committee against the appointment of Colonel Noble, to which there has been objection because that officer, if made a permanent brigadier general in the regular medical corps, would "jump" a large number of his present seniors of the permanent personnel in the grades of lieutenant colonel and colonel. Senator McKellar, of Tennessee, member of the Senate military committee, was particularly insistant for the confirmation of Colonel Noble, and at one time he so engineered the program that the military committee had reported favorably on both the McCaw and Noble nominations, only to have the action recalled. At the last moment in the late session the subject again came up and the opposition to the Noble nomi-

nation led Mr. McKeller to have other nominations, not concerned in any way with the appointment of Colonel Noble, laid aside. It is probable that the Senate military committee, before acting on these medical corps recess appointments, will conduct an investigation into the circumstances of the nominations.—*Army and Navy Register, March 8.*

PROMOTION IN ARMY MEDICAL CORPS.

The provisions of section 10 of the national defense act, relative to promotions in the Army Medical Corps, which were suspended by the act of October 6, 1917, were made operative from December 10. The act of October 6 removed for the period of the war the requirements that first lieutenants in the medical corps shall serve five years before they are entitled to be promoted to the grade of captain. With the provision of section 10 again operative, no service may be counted toward promotion in the medical corps except that rendered under a permanent commission. All officers who had completed one year's service prior to Dec. 10 have been promoted.—*Army and Navy Register, March 15.*

NURSES.

Most women spend a good many hours during their lives taking care of sick people. Occasional sickness is about as normal in any household as the more frequent hunger, and the womenfolk officiate in the sick room just as they do in the kitchen. They have as assets a natural aptitude and a family medicine cabinet, the heritage of grandmother as modified by Dr. Evans and others. But the community has not interested itself until recently in training this aptitude to any better purpose and the influenza epidemic showed that there were not enough nurses.

Family and community suffered because there were not enough nurses or enough women of slight training to serve the community. There were plenty of women, but not enough competent women. The family medicine cabinet, backed by traditional sick room methods, failed in the emergency.

Communities all over the United States are becoming interested in enlarging the number of women trained to competency in the sick room. It is suggested in the east that high school girls be required to learn some of the elementary things in the care of the sick as a part of high school education. It has been suggested in Chicago that short courses be given by Chicago hospitals for women who want to know something of nursing, but who cannot afford to become registered nurses.

No confusion should be permitted between the short term nurse and the registered nurse. There need be no confusion. The highly trained registered nurses must have their standards protected. They will not be undermined by increased competency of every woman in the duties of the sick room. — *Chicago Tribune.*

DENTAL CORPS ORDERS FROM WAR DEPARTMENT.

DENTAL CORPS.

Lieut. Col.. Minot E. Scott to Hoboken, N. J., port of embarkation, for duty.

Maj. Crittenden Van Wyck to Sheffield, Ala., nitrate plant No. 1, for duty.

Maj. Arnett P. Matthews to United States and report for instructions.

Maj. Guy P. Bannister report to Washington for duty in office of attending surgeon.

Maj. Ben H. Sherrard to Washington and report to director of purchase, storage and traffic for duty.

Maj. Rumsey F. Rowdybush to Walter Reed General Hospital, D. C., for duty.

Promotions of following first lieutenants as captains in dental corps, permanent establishment, from July 13, 1918, announced: Samuel J. Rohde, Leroy P. Hartley, Frederick C. Daniels, Nathan C.

Pickles, Robert L. Lowry, Oliver J. Christiansen, Timothy Harden, Lawrence K. Anderson, Timothy F. Leary. Wm. C. Webb, Jr., Edward C. Alley, Clinton R. Boone, David I. Edwards, Orville A. Grove, Roy M. Kiesner, Edward A. Thorne, Lynn H. Tingay, Claude R. Hollister and Marhl H. Welch.

With rank from Oct. 4, 1918: Walter D. Vial, Richard K. Thompson, Leslie S. Harlan, Neil J. McCollum, Clement J. Gaynor, Walter A. Rose, Melvin R. Eiche, George Krakow, Eugene A. Smith, Jerome S. Fritsche, Clarence J. Wright, Milton A. Price, Wm. H. Hoblitzell, Francis M. Tench, Alvin E. Anthony, Wm. J. R. Akeroyd, Fletcher D. Rhodes, Wm. B. Caldwell, Lewis W. Maly, Arthur T. Burchill, Glover Johns, Frederick W. Herms, Harold J. Parker, Leslie D. Baskin, Curtis W. Hallam, James E. Dean, Henry L. Hogan, John C. Campbell, Leland S. Wilson, Benjamin H. Dean, Dell S. Gray, Wm. B. Stewart, Julius L. Bishof, Charles H. Brammell, John A. Rowe, Wm. T. Williams, Hocker O. Lindsey, Alvin D. Dannheiser, James R. Conner, Robert L. Strickland, Roy R. Newman, Boyd L. Smith, Avery G. Holmes, George R. Kennebeck, Alexander M. Smith, Jr., Horace R. Finley, Cecil R. Hays, Roy C. Starr, Harold S. Embree, Charles L. Andrews, Joseph L. Boyd, Joseph L. Rahm, Clarence R. Jacobson, Norman M. Mackenzie, Richard F. Thompson, Henry H. Collins and Adrian C. Ragan.

With rank from Oct. 8, 1918: Byram S. Purviance.

With rank from Nov. 24, 1918: Horace S. Villars, Donald G. Russell, Allen D. Lazenby, Patrick F. McGuire, James W. McClaran, Louis F. Boyd, Tom S. Mebane, Edmund B. Spaeth, Philip L. Coulter, James B. Montgomery, Percy E. Duggins, Brown S. McClintic, Henry K. B. Hufford, Joseph G. Fernbach, Howard H. Dignan, Charles W. Sale, Robert H. Lowry, Jr., Hertel P. Makel, Ward S. Wells, Seymour C. Schwartz, Purgh S. Burnet, Karl F. Kesmodel, Ross Golden, Curtis D. Pillsbury, Nelson A. Myll, John R. De Velling, Roy L. Scott, Wm. W. Southard, George H. Dorsey, Lauret L. La Roche, Henry C. Dooling, Frank S. Matlack, Cleon J. Gentzkow, James P. Crawford, Robert A. Hale, Allen R. Howard, Benjamin B. Rowley, Henry C. Bradford, Harry H. Towler, Oral B. Bollbaugh, Joseph R. Jones, Harold E. Clark, Roland A. Davidson, Charles R. Snyder, Haskett L. Conner, Edward B. Macon, Percy J. Carroll, Virginius Minervini, James V. Falisi, Wm. D. Petit, Glenn H. Reams, Jay De P. Mingos, Allan W. Dawson, John W. McKeever, Ottis L. Graham, Edwin H. Roberts, Arthur M. Bacon, John J. Moore, Anthony J. Vadalo, Maurice S. Weaver, John M. Stanley, Arthur H. Nylon, Myron P. Rudolph, Noble DuB. McCormick, Charles E. Sima, Bascom H. Palmer, Harold D. Rogers, John R. Hall, Arthur R. Gaines, Wm. L. Starnes, Wm. A. Boyle, Manton L. Shelby, Paul H. Streit, John E. Robinson, Lewis E. J. Browne, Ernest K. Stratton, James A. Orbison, Paul M. N. Kyle, Wm. C. Whitmore, Albert B. Pavy, Francis E. Evans, Charles E. Brenn, Francis T. Duffy, Leonard W. Weaver, Louis Felger, Leo S. Trask, Raymond A. Tomassene, Lowd W. Ballantyne, Otto R. Brown, Charles E. Yoho, Cornelius A. Denehy, Joseph P. Madigan, Robert K. Simpson, Patrick S. Madigan, Frederick B. Little, Chester A. Stayton, Herbert W. Rogers, John R. Evers, Ralph E. Curti, Daniel C. Hankey, Frederick A. Blesse, Charles C. Dickey, George B. Fletcher, Walter H. Mytinger, John J. Carden, Henry E. Fraser, John R. Whisenant, Harold H. Golding, Harry P. Shugerman, Wm. C. Pollock, Wm. W. McCaw, Edward H. Tonolla, Earle D. Quinnell, Harold O. Brown, Douglas H. Mebane, Paul B. Johnson, Irving K. Lovett, Montreville A. St. Peter, Frank McA. Moose, Percy K. Telford, Benjamin F. Pence, Wayne R. Beardsley, Warren Stirling, Don G. Hilldrup, Richard S. Magee, Wm. A. Smith, Frank W. Pinger, Ivy A. Pelzman, Edward S. Murphy, Richard E. Werlich, Herbert R. Stolz, Louis de K. Belden, Andrews W. Smith, Willard S. Howard, Philip P. Green, Wm. H. Barrow, Godron F. Wiley, Frank A. Plum, Charles R. Irving, Wm. W. Jones, Charles C. Hawke, Noland M. Canter, Pierre N. Charbonnet, James C. Kimbrough, Meredith R. Johnston, Merril K. Lindsay, Wm. D. Middleton, Leon H. Cornwall, Read B. Harding, James W. Duckworth, Bradford Massey, Edgar H. Howell, George W. Snyder, Paul S. Wagner, John A. P. Millet, Joseph D. Foley, Lewis A. Newfield, Thomas M. Leahy, Louis A. La Garde, Jr., and Edward L. Moore.

—Army and Navy Register.

Colonel John H. Hess to Chicago and report to commanding general Central Department for duty.

Col. Alden Carpenter report at Fort Sam Houston, Tex., for duty as Southern Department dental surgeon.

Lieut. Col. George I. Gunckel to Army Medical School for physical examination for tropical service.

Maj. William A. Squires to Fort McPherson, Ga., for duty.

Maj. Harry C. Peavy to Ayer, Mass., Camp Devens, for duty.

Maj. Charles De W. Deyton to Camp Lee, Va., for duty.

Maj. Richard B. Clark to Washington and report to director of purchase, storage, and traffic division for duty.

Maj. Archibald L. Miller to Fort McHenry, Md., general hospital 2, for duty.

—Army and Navy Register, March 22.

NATIONAL SOCIETIES, 1919.

October.

20-24—New Orleans, National Dental Association.

20-24—New Orleans, National Association of Dental Faculties.

20-24—New Orleans, National Association of Dental Examiners.

20—New Orleans, Delta Sigma Delta.

20-24—New Orleans, Xi Psi Phi Fraternity.

20-24—New Orleans, Association of Military Dental Surgeons.

STATE SOCIETIES.

April.

7-8-9-10-11—Alabama, Birmingham.
7-8-9-10-11-12—Michigan, Detroit.
9-10-11—West Virginia, Wheeling.
14-15-16—Missouri, St. Louis.
15-16-17—Connecticut, Hartford.
15-17—Mississippi, Clarksdale.
20-30-May 1—Pennsylvania, Pittsburgh.
22-25—Texas, Waco.
28-29-30—Kansas, Topeka.

May.

1-2-3—South Dakota, Mitchell.
6-7-8—Iowa, Des Moines.
7-8-9—Massachusetts, Boston.
13-14-15-16—Illinois, Peoria.
19—Arkansas, Pine Bluff.
20-21-22-23—Indiana, Indianapolis.
20-21-22—Nebraska, Omaha.
California Southern, Los Angeles.
North Dakota, Fargo.

June.

9-10-11-12—Kentucky, Louisville.
11-12-13—Georgia, Savannah.
12-13-14—New York, Syracuse.
18-19-20—Florida, Tampa.
18-19-20—New Hampshire, Manchester.
19-20-21—Colorado.
19-20-21—South Carolina, Columbia.
26-27-28—New Mexico, Albuquerque.
Maine. Place to be announced.
Maryland, Baltimore.
Utah, Ogden.

July.

8-9-10—Wisconsin, Milwaukee.
24-25-26—Montana, Butte.
New Jersey. Place to be announced.

October.

21—Louisiana, New Orleans.
Rhode Island, Providence.

December.

2-3-4—Ohio.

DATES TO BE ANNOUNCED.

Arizona, Phoenix.
California State, San Francisco.
North Carolina, Asheville.
Tennessee, Nashville.
Virginia, Richmond.
Washington, Seattle.

WEST VIRGINIA STATE BOARD OF DENTAL EXAMINERS.

The next meeting of the West Virginia State Board of Dental Examiners will be held in Wheeling, W. Va., beginning at 9 o'clock on Tuesday morning, June 24th, 1919. For further information and application blanks address,

R. MASON HITE, Sec'y,
Mannington, W. Va.

MISSOURI STATE DENTAL ASSOCIATION.

The 54th annual meeting of the Missouri State Dental Association will be held at Hotel Statler, St. Louis, April 14, 15, 16, 1919.

The first two days of the meeting will be devoted to clinical instruction in the most advanced phases of modern dental practice, by a staff of competent and experienced teachers. The special clinicians and their subjects are: Dr. Justin D. Towner, Memphis, Periodontia; Dr. George Thompson, Chicago, Dental Ceramics and Removable Bridges; Dr. Boyd Bogle, Nashville, Radiodontia and Oral Surgery; Dr. Gillett Hayden, Columbus, Preventive Dentistry; Dr. S. L. Silverman, Atlanta, Conductive Anesthesia and Root Resection; Dr. H. A. Maves, Minneapolis, Crown and Inlay Technic; Dr. Philip R. Thomas, Minneapolis, Periodontia.

A general clinic session of individual and group clinics will be given the afternoon of the 16th. The title of all clinics must be sent to Dr. Charles P. Grosby, Frisco Building, St. Louis, before March 24. Members of the National Dental Association are invited to attend the meeting and contribute to the clinical program.

H. CARLYLE POLLOCK,
GEORGE W. HILLIAS,
CLARENCE O. SIMPSON, Chairman,
Publicity Committee.

IOWA STATE DENTAL SOCIETY MEETING.

The annual meeting of the Iowa State Dental Society will be held in Des Moines, Iowa, May 6-7-8, 1919. An interesting program has been arranged. Men from out of the state holding National cards are cordially invited to attend all sessions.

For further information address,
DR. E. R. SWANK,
C. N. B. Bldg., Des Moines, Iowa.

ANNUAL MEETING OF THE SOUTH DAKOTA STATE DENTAL SOCIETY.

The South Dakota State Dental Society will hold its 37th annual meeting at Mitchell, May 1, 2, 3, 1919. A program of unusual interest is being prepared. A cordial invitation is extended to all members of the National Dental Association to attend this meeting.

E. W. ELMEN, Secretary,
Sioux Falls, South Dakota.

ANNUAL MEETING SOUTH CAROLINA STATE DENTAL ASSOCIATION.

The annual meeting of the South Carolina State Dental Association will be held in Columbia, South Carolina, June 19, 20, 21. The place is South Carolina University Campus.

ERNEST C. DYE, Secretary,
Greenville, S. C.

NORTHERN OHIO DENTAL SOCIETY.

Northern Ohio Dental Society will meet June 2nd, 3rd and 4th, at the Hotel Statler, Cleveland, Ohio.

GEO. B. SMITH, Sec'y.

OKLAHOMA STATE BOARD OF DENTAL EXAMINERS.

The next meeting of the Oklahoma State Board of Dental Examiners will be held in the Senate Chamber, State Capital Building, Oklahoma City, on July 14th, 1919.

A recent law enacted provides for an annual license fee of $1.00 and further provides that failure to pay automatically cancels the license to practice in the state.

For further information address,
H. R. WATKINS, Secretary,
240 American Nat'l Bank Bldg,
Oklahoma City, Okla.

PENNSYLVANIA STATE DENTAL SOCIETY.

The Fifty-first annual meeting of the Pennsylvania State Dental Society will be held at the William Penn Hotel, Pittsburgh, Penn., Tuesday, Wednesday and Thursday, April 29, 30 and May 1, 1919. An interesting and instructive program has been prepared. All ethical practitioners are invited to attend.

J. F. BIDDLE, Secretary,
517 Arch St., Pittsburgh, Pa.

KENTUCKY STATE DENTAL SOCIETY MEETING.

The Fiftieth Anniversary—Jubilee Meeting—of the Kentucky State Dental Association will be held in Louisville, Ky., June 9-10-11-12, 1919.

A Post-Graduate course of unusual interest has been planned.

Address all correspondence to

W. M. RANDALL, Sec'y,
1035 Second St.,
Louisville, Ky.

ANNUAL CONVENTION OF THE TEXAS STATE DENTAL SOCIETY.

The thirty-ninth annual convention of the Texas State Dental Society will be held at Waco, Texas, April 22nd to 25th, 1919.

Several men of national prominence will conduct the post-graduate feature of the meeting, which will supplement the program of papers and clinics by members of the Society.

J. G. FIFE, Secretary,
736 Wilson Building,
Dallas, Texas.

THE DENTAL SOCIETY OF THE STATE OF NEW YORK.

The Dental Society of the State of New York will hold its 51st annual meeting June 12, 13, 14, 1919, at the Hotel Onondaga, Syracuse, N. Y. All ethical dentists, residents of New York and those residing in adjoining states are cordially invited to be present at the sessions of the Society.

Dr. A. C. Bickelhaupt, City Bank Bldg., Syracuse, N. Y., is Chairman of the Exhibits Committee.

A. P. BURKHART, Secretary,
52 Genesee St., Auburn, N. Y.

MEETING OF THE VERMONT BOARD OF DENTAL EXAMINERS.

The next meeting of the Vermont Board of Dental Examiners, for the examination of candidates to practice in Vermont, will be held at the State-house, Montpelier, commencing at 2 P. M. on June 30th, 1919, and continuing for three days.

To be eligible for examinations a candidate must be (1) twenty-one years of age, (2) A graduate of a high school of the first class, and (3) a graduate of a reputable dental college.

Applications must be in the hands of the Secretary not later than June 21st.

For further information apply to

HARRY W. HAMILTON, Sec'y,
Newport, Vermont.

VIRGINIA STATE BOARD OF DENTAL EXAMINERS.

The next meeting of the Virginia State Board of Dental Examiners will be held in Richmond, Va., beginning at 9 o'clock on Tuesday morning, June 24th, 1919.

For further information and application blanks address:

J. LEWIS WALKER, Sec'y,
505 Taylor Bldg., Norfolk, Va.

MISSISSIPPI BOARD OF DENTAL EXAMINERS.

The next meeting of the Mississippi Board of Dental Examiners will be held in the Senate Chamber, State Capitol,

Jackson, Miss., on the third Tuesday in June. For application blanks and further information address,

B. J. MARSHALL, Secretary,
6-7 Turner-Cox Bldg., Marks, Miss.

INDIANA STATE BOARD OF DENTAL EXAMINERS.

The next meeting of the Indiana State Board of Dental Examiners will be held at the State House, Indianapolis, June 23rd to 28th, inclusive. For application and instructions write to H. C. McKittrick, Secretary-Treasurer, 605 Hume Mansur Building, Indianapolis.

Yours very truly,
H. C. McKITTRICK, D. D. S.

PSI OMEGA FRATERNITY.

The 22th annual banquet of the New York Alumni Chapter will be held at the Hotel Commodore, 42nd St. and Lexington Ave., New York City, Saturday, May 3rd, 1919, at 6:30 P. M. Every Psi Omega in this vicinity is cordially and fraternally invited to be present to help welcome those of our brothers who have been in the service. Send your name and address to:

JOHN L. PETERS, D. D. S.,Treas.,
133 West 72nd St., New York City.

SOUTH DAKOTA STATE BOARD OF DENTAL EXAMINERS.

The next meeting of the South Dakota State Board of Dental Examiners will be held in Sioux Falls, South Dakota, June 25th, 26th, 27th, 1919, beginning promptly at 9:00 A. M. June 25th.

All applications must be in the hands of the Secretary by June 20th. Fee for examination, $25.00. No reciprocity or interchange. Full information and application blanks may be received by addressing,

L. S. SPENCER, Secretary,
Watertown, South Dakota.

SOUTH CAROLINA STATE BOARD OF DENTAL EXAMINERS.

The next meeting of the South Carolina State Board of Dental Examiners will be held at Bamberg, S. C., commencing promptly at 9 o'clock, Monday morning, June 16th, 1919. All applications should be in the hands of the secretary by June 6th.

R. L. SPENCER, Secretary,
Bennettsville, S. C.

ANNUAL MEETING OF THE ALUMNI SOCIETY OF THE PHILADELPHIA DENTAL COLLEGE.

The annual meeting of the Alumni Society of the Philadelphia Dental College (Temple University) will be held on Wednesday, April 16, 1919, in the College Building at 18th and Buttonwood Sts. All members should be present.

FRANKLIN S. FLUCK,
Chairman of Publicity Committee,
2440 North 7th St.,
Philadelphia, Pa.

NORTH CAROLINA STATE BOARD OF DENTAL EXAMINERS.

The next meeting of the North Carolina State Board of Dental Examiners will be held at Asheville, N. C., beginning promptly at 9:00 o'clock on Monday morning, June 23rd, 1919. For further information and application blanks, address, F. L. HUNT, Sec'y,
Asheville, N. C.

ONTARIO DENTAL SOCIETY.

The Ontario Dental Society will hold its annual meeting in Toronto, Ontario, Monday, Tuesday, Wednesday and Thursday, April 28th, 29th, 30th and May 1st, 1919.

J. E. RHIND, President, Toronto.
J. A. BOTHWELL, Secretary,
604 Spadina Ave., Toronto.

NORTHERN OHIO DENTAL ASSOCIATION MEETING.

The Northern Ohio Dental Association will meet in Cleveland, Ohio, June 2nd, 3rd and 4th, at Hotel Statler. In connection a Post Graduate Course will be held from the 2nd to 6th, inclusive, consisting of the following:

"Nerve Blocking Anesthesia."

By Dr. Arthur E. Smith, of Chicago.

"Attachments to Vital Teeth."

By Dr. Edward Tinker, of Minneapolis.

"Prosthesis."

By Dr. M. M. House, of Indianapolis.

GEORGE B. SMITH, Sec'y,
Fremont, Ohio.

SOUTH CAROLINA STATE BOARD OF DENTAL EXAMINERS—CHANGE OF DATE.

The meeting of the South Carolina State Board of Dental Examiners has been postponed until June 30th. The examinations will begin promptly at 9 o'clock, Monday morning, June 30th, at Bamberg, S. C.

All applications must be in the hands of the secretary by June 20th.

Application blanks and further information may be obtained by addressing,

R. L. SPENCER, Secretary,
Bennettsville, S. C.

MEETING OF THE MAINE BOARD OF DENTAL EXAMINERS.

The Maine Board of Dental Examiners will hold their regular examination, beginning July 1st, 1919, at 8:30 at the State House.

All applications and fee of $20.00 must be in the hands of the Secretary by June 21st.

The examination for Dental Hygienists will be given at the same time, fee $10.00.

WILL S. PAYSON, Secretary,
Castine, Maine.

ANNUAL MEETING OF THE CALIFORNIA STATE DENTAL ASSOCIATION.

The 1919 session of the California State Dental Association will be held at the University of California, San Francisco, Cal., June 23, 24, 25, 26, 27 and 28. The meeting will be conducted on the post-graduate plan. Members of other Associations are invited providing their 1919 dues are paid and that they shall pay the special fee for that course in which interested. For further information, address the Secretary, J. E. Gurley, 350 Post St., San Francisco.

Very truly yours,
CALIFORNIA STATE DENTAL ASSOCIATION.
John E. Gurley, Secretary.

MISSOURI DENTAL BOARD.

The Missouri Dental Board will hold their regular examination for examining applicants to practice dentistry in Missouri at Jefferson City, on Monday, Tuesday, and Wednesday, June 9-10-11, beginning at 8 o'clock A. M. on Monday.

The practical examination will also be given at the Kansas City Colleges on Monday and Tuesday, May 5th and 6th, and at the St. Louis Colleges on Friday and Saturday, June 6th and 7th.

It is much more convenient for the applicants to take the practical examination at the Colleges. The practical examination will also be given at Jefferson City.

V. R. McCUE, Secretary,
Cameron, Mo.

PSI OMEGA FRATERNITY MEETING.

October 20-24, New Orleans, Psi Omega Fraternity. Grand Chapter meeting and National Alumni Chapter meeting.

M. M. PRINTZ,
25 E. Washington, Chicago, Ill.

ANNUAL MEETING OF THE NORTH CAROLINA STATE SOCIETY.

The North Carolina Dental Society will hold its next annual session, June 25, 26 and 27 at Asheville, N. C. Headquarters Battery Park Hotel.

W. T. MARTIN, Secretary,
Benson, N. C.

ANNUAL HOME-COMING CLINIC.

The Northwestern University Dental School Annual Home-coming Clinic will be held June 16th and 17th. A splendid program has been arranged for each day, covering subjects of vital interest in the practice of modern dentistry.

For information please communicate with the secretary of the alumni association. M. M. PRINTZ, Chicago,
25 E. Washington St.

DR. W. C. DENNIS, ELECTED PRESIDENT.

Dr. W. C. Dennis, of Jackson, has been elected President of the Mississippi Dental Association, to serve the unexpired term of Dr. Varnado, who resigned on account of moving from the State.

Dr. Dennis was Vice-President before being elected President.

W. F. BEAVERS, Secretary,
Meridian, Miss.

THE JOHN R. CALLAHAN MEMORIAL.

At the December, 1918, meeting of The Ohio State Dental Society, a resolution was adopted to perpetuate the memory of the late John R. Callahan in recognition of his contributions to the science and art of dentistry and his unselfish devotion to its advancement thruout the many years of his professional life.

The committee to which this memorial was referred has decided on the following as the most appropriate, and worthy of the approval, of the profession.

1st—A Bronze Memorial to be placed in The Cincinnati General Hospital Grounds.

2nd—A Callahan Memorial Research Fund. The income from which, to be awarded from time to time to the person making the best contribution to The Science and Art of Root Canal Problems. The fund and award to be under the direction of a committee perpetuated by The Ohio State Dental Society. The prize to be known as The John R. Callahan Award.

The sum necessary in the minds of the committee to carry out the memorial in its two phases should approximate $8000.00 an amount that should speedily be raised in these times when the spirit of giving is universal.

Subscriptions to this fund by individuals or societies will be duly credited and should be forwarded to the Secretary-Treasurer of the fund.

T. IRVING WAY, Chairman,
No. 52 Groton Building, Cincinnati.
HENRY E. GERMANN, Sec'y-Treas.,
No. 719 Gwynn Building, Cincinnati.
L. L. BARBER, Toledo.
WESTON A. PRICE, Cleveland.
L. E. CUSTER, Dayton.
EDWARD C. MILLS, Columbus,
Committee.

THE WORLD WAR

Has Opened the Eyes of Nations Everywhere to the Part Dentistry Plays in the Conservation of Health.

"What wonderful teeth these American Soldiers have."

This was the famous and oft repeated saying in the capitals and cities of Europe.

What was accomplished in a small way during the war must now begin in earnest in time of peace. Nations must be taught that bad teeth means bad health.

The problems that the National Den-

tal Association must solve now are larger than any it has ever faced.

The National Convention to be held at New Orleans, Louisiana, on October 20, 21, 22, 23 and 24, 1919, will in all probability be the most important in the history of dentistry.

"Dentistry must play its part in the era of reconstruction."

C. V. VIGNES, President.

JOSEPH P. WAHL, Local Chairman.

ANNUAL MEETING OF THE MICHIGAN STATE DENTAL SOCIETY.

The sixty-third annual meeting of the Michigan State Dental Society will be held at the Statler Hotel, Detroit, April 7, 8, 9, 10, 11, 12, 1919.

An all Michigan program is to be provided. The first three days will be devoted to the general session. April 10-11-12 to the Post-Graduate Course conducted by the Detroit Dental Club Clinic.

C. J. LYONS, President,
Ann Arbor, Mich.

CLARE G. BATES, Secretary,
Durand, Michigan.

ANNUAL MEETING NEW MEXICO DENTAL SOCIETY.

The next meeting of the New Mexico Dental Society will be held in Albuquerque, June 26, 27 and 28, 1919.

J. J. CLARKE, Secretary,
Artesia, New Mexico.

BOOKS AND JOURNALS WANTED FOR A NATIONAL DENTAL ASSOCIATION LIBRARY.

The Association is gathering material for a great national dental library. We need your assistance. Send us the following items: Dental text books, old or new; dental journals, college year books, college announcements, State Board dental reports, State Dental Society bulletins and programmes, State Board reports, photographs, engravings or prints of dentists; any print or picture relating to the practice of dentistry.

If the shipment weighs under fifty pounds send it by express, collect. If over that amount before sending please ask for shipping directions.

Address: The National Dental Association, 127 No. Dearborn St., Chicago, Illinois.

BACK COPIES OF 1918 JOURNAL.

Several of the medical and dental libraries need extra copies of the 1918 Journal. This volume will be bound and placed on the shelves of the library for reference work. Therefore, if our readers who do not intend to bind this volume will send it to us, by express, collect, we will appreciate it.

DR. OTTO U. KING, Sec'y,
National Dental Association,
127 No. Dearborn St., Chicago, Ill.